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Oceanographic Observations During LIMEX, March 1987

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Les établissements des Sciences et levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports en décembre 1981. Une liste complète de ces publications figure dans le volume 39, Index des publications 1982, du *Journal canadien des sciences halieutiques et aquatiques*. La série actuelle a commencé avec la publication du rapport numéro 1 en janvier 1982.

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by

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ABSTRACT

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Oceanographic and meteorological data collected during the Labrador Ice Margin Experiment (LIMEX) in March 1987 are presented in graphic forms. The data include ocean current, temperature/salinity of water, wind, barometric pressure, air temperature and ice drift. Methods of data collection and data analysis are described.

RÉSUMÉ

Tang, C.L. 1989. Oceanographic observations during LIMEX, March 1987. Can. Data Rep. Hydrogr. Ocean Sci. No. 72: vii + 202 pp.

On présente, sous forme de graphiques, des donées océanographiques et météorologiques recueillies durant l'expérience sur la marge glaciaire du Labrador (LIMEX), en mars 1987. Ces données portent notamment sur les courants océaniques, sur la température et la salinité de l'eau, sur le vent, sur la pression barométrique, sur la température de l'air et sur la dérive de la glace. On en décrit également la collecte et l'analyse.

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1. Introduction

During the winter and spring months each year, the waters of the northern Grand Banks and the Newfoundland Shelf are covered with sea ice. Under severe conditions, sea ice can interfere with offshore drilling operations and hamper marine shipping. For planning of save offshore operations, it is important to understand the dynamics of ice movement and to develop techniques to predict the extent of ice cover.

In March 1987, a multi-disciplinary research program, the Labrador Ice Margin Experiment (LIMEX), was launched to collect field data for a number of sea ice studies. The experiment involved scientists from four countries in different areas of expertise. The three major components of the experiment are oceanography, remote sensing and ice physics. A summary of the various scientific programs in LIMEX are given in Tang et. al.(1987) and McNutt et.al.(1988). The objectives of the oceanography program in LIMEX are

1. to study oceanographic processes and ice-ocean interactions that are important to ice movement, ice melt, ice extent variation;
2. to determine ice and oceanic conditions in the southern marginal ice zone of the Labrador ice pack.

To achieve these objectives, an expedition to the Newfoundland Shelf on C.S.S.Baffin was organized in conjunction with an aircraft program of the remote sensing study based at Gander, Newfoundland. Data collected on Baffin include wind, ocean current, temperature and salinity under ice and in the open ocean, and ice drift. This report presents the data in graphic forms, and gives pertinent information about the methods of data collection

and data processing. Other data obtained during LIMEX, i.e., remote sensing, ice surface characterization, ice properties, wave-induced ice motion, aerial photography and ocean waves are contained in a data report entitled "Labrador Ice Margin Experiment, March 1987: Sea ice and remote sensing data report" compiled by B. Holt of Jet Propulsion Laboratory.

2. C.S.S. Baffin cruise

B.I.O. cruise number: 87-002

Participants, affiliations and responsibilities:

C.L. Tang	CO/BIO	Chief scientist
A. Hartling	CO/BIO	Chief engineer
T. Foote	CO/BIO	Field supervisor
P. Keenan	CO/BIO	Electronic technician
L. Bellefontaine	CO/BIO	Data technician
D. MacNeill	CO/BIO	Data technician
P. Pozdnekoff	OC/BIO	Mechanical technician
G. Boudreau	OC/BIO	Computer specialist
S. Argus	RA	Remote sensing coordinator
F. Carsey	JPL	Scientific advisor
B. Holt	JPL	Ice data collection
J. Crawford	JPL	Radio communication
L. Solar	AES	Ice observation
R. Macedo	CA	Graduate student, ice properties

M. Drinkwater	SC	Graduate student, ice properties
A. Lohanick	NA	Passive radiometry
W. Winsor	CC	C-CORE team leader
C. Tuff	CC	Ice motion, ice properties
A. Steel	CC	Ice properties
J. Ransom	MO	Coordinator
M. Elfers	AL	Omegasonde target tracking
G. Genz	AL	Omegasonde target tracking
L. Thomas	DA	Ocean wave measurement
D. Weir	MA	Meteorological observation
A. Perly	CG	Helicopter pilot
P. Gammon	CG	Helicopter engineer

Affiliation codes:

CO/BIO	Coastal Oceanography Division, Bedford Institute of Oceanography
OC/BIO	Ocean Circulation Division, Bedford Institute of Oceanography
CC	C-CORE, Memorial University of Newfoundland
MO	Mobile Oil of Canada
RA	RADARSAT, Department of Energy, Mines and Resources
AES	Atmospheric Environmental Service, Department of Environment
JPL	Jet Propulsion Laboratory (U.S.A.)
CA	California Institute of Technology (U.S.A)
SC	Scott Polar Research Institute (U.K.)
AL	Alfred-Wegener Polar Research Institute (F.R.G.)
DA	David-Taylor Naval Research & Development Center (U.S.A.)

NA	Naval Ocean Research & Development Agency (U.S.A.)
MA	MacLaren Plansearch Limited
CG	Canadian Coast Guard

3. Summary of programs on Baffin

March 14 Scientific parties joined ship at St. John's.

March 15 Sailed 12:30 NST. Heavy ice encountered outside St. John's harbor. Deployed lauch at a lead edge. Ship stayed in ice all night.

Narch 16 Deployed personnel from basket to ice floe. First portable CTD on ice. Ship moved very slowly towards ice edge near Cape Race.

March 17 Informal science presentation in the morning. Off Cape Race late in the afternoon. At ice edge 20:15.

March 18 In open water. Deployed Minimet. Steamed north towards ice edge. CTD along the way.

March 19 Laid current meter mooring south of ice edge. Deployed two launches to ice edge for ice samples. First ice motion package deployed from ship. Ship moved into pack ice and stayed in ice till next day.

March 20 Two ice floe stations. First S4 measurement. Ship stayed in ice all night.

March 21 First remote sensing overflight. Ship drifting during overflight till 14:00. Moved to open water for two CTD sections.

March 22 A ARGOS drifter deployed at ice edge. First aerial photography

flight on helicopter. Long CTD east-west transect overnight.

March 23 Returned to ice edge after completing CTD. Dropped personnel on ice floe and then moved to open water to deployed wave buoy. Second remote sensing overflight. Five ice CTD station from helicopter. Left study site for southern ice edge. CTD 1/2 mile from shore along the way.

March 24 CTD and Batfish tows south of Avalon. Steamed back to eastern edge at night.

March 25 Deployed 7 Omegasonde targets and 4 ARGOS beacons on ice. Four ice floe stations in a line from ice edge to pack ice. Deployed thermistor chain buoy at ice edge. Tracked Omegasonde targets all night.

March 26 Last remote sensing overflight. Three ice floe stations. Eleven ice CTD stations. CTD till next morning.

March 27 CTD transect ended at current meter mooring site. Recovered mooring. Steamed south to Minimet site and recoved mooring. steamed towards St. Pierre Bank.

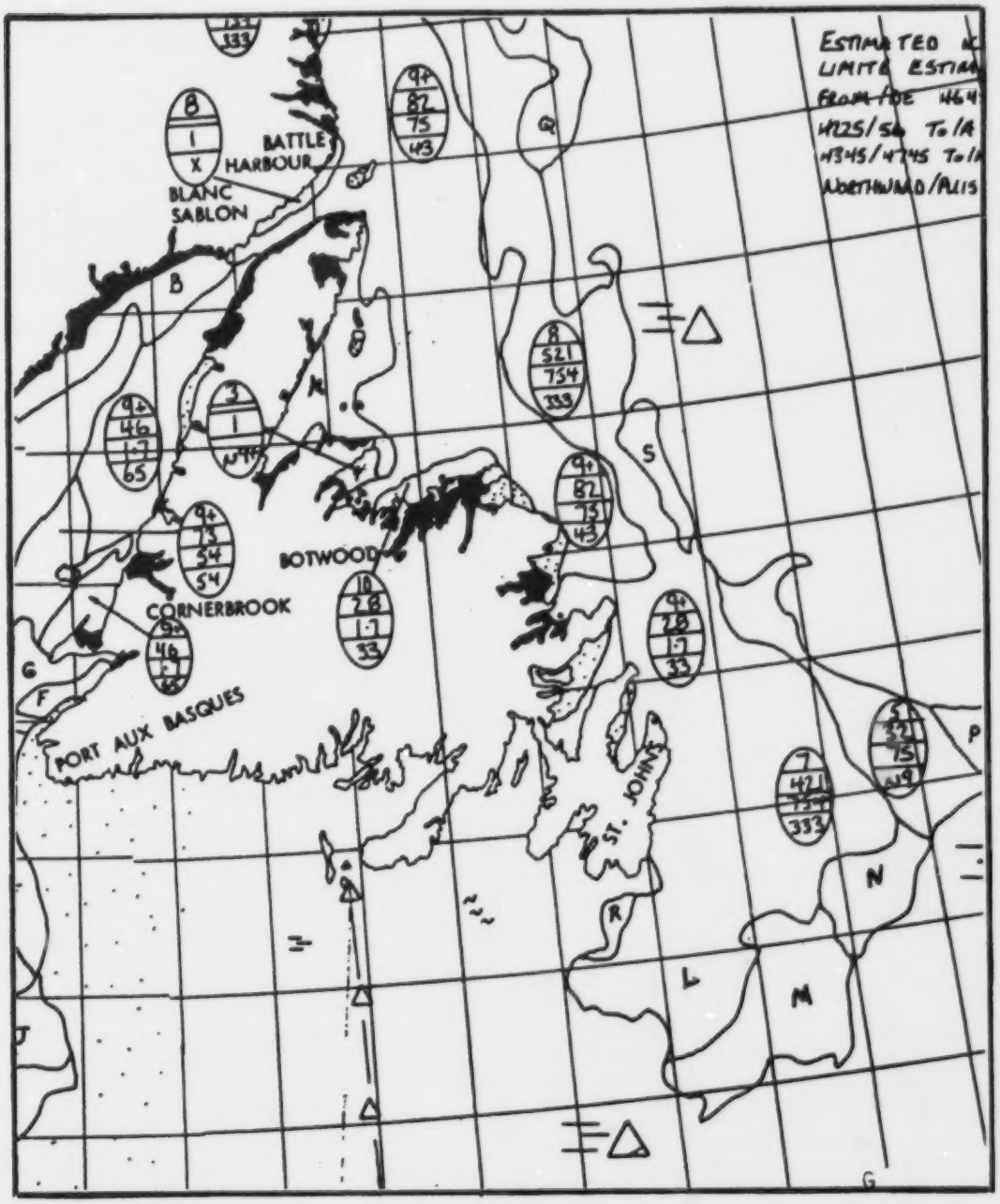
March 28 Passed Hermes pressure buoy on St. Pierre Bank. Abandoned plan to retrieve mooring due to heavy fog.

March 29 Arrived BIO 17:30.

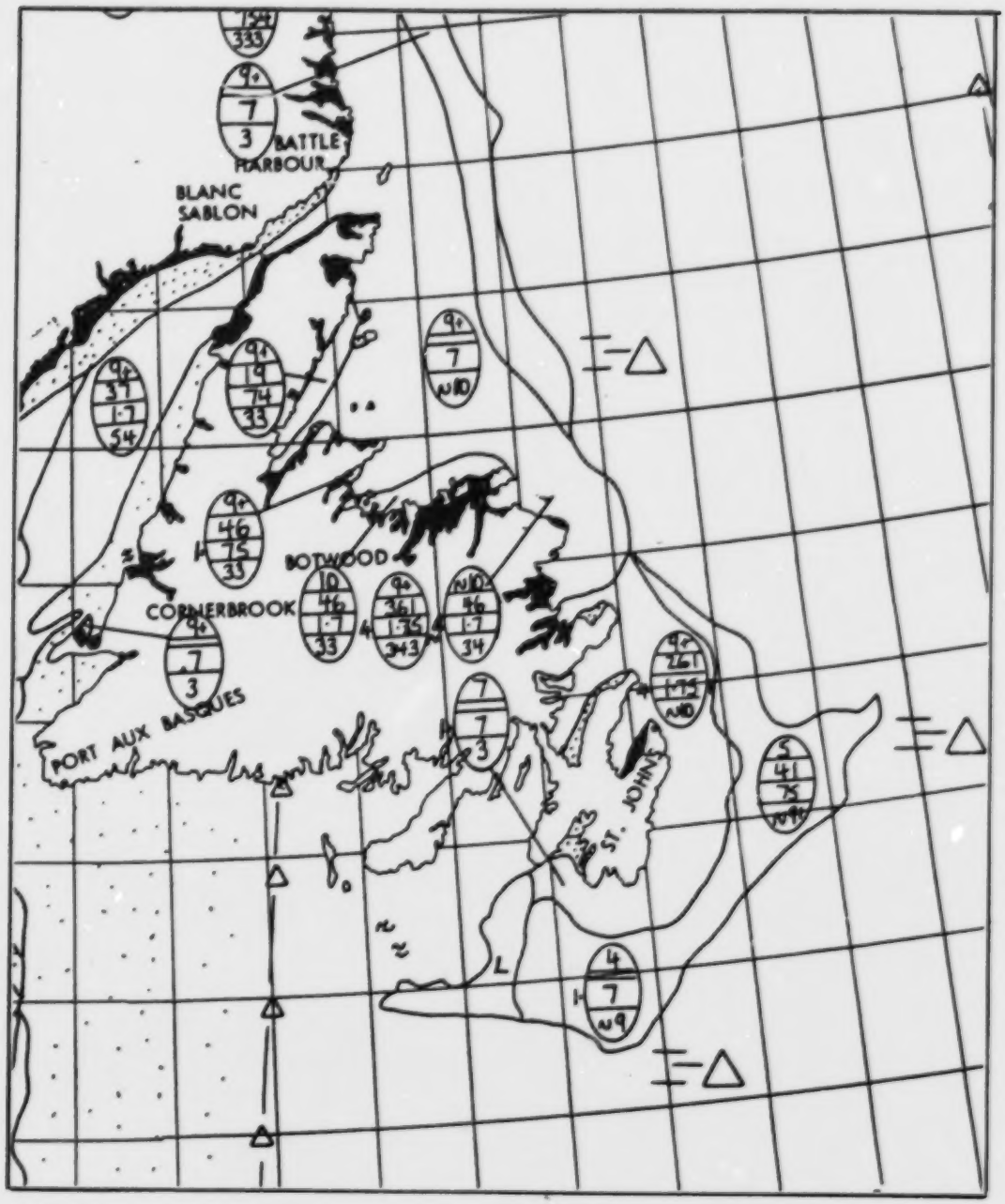
4. Ice conditions

During the first week of the cruise, change of ice conditions was very

rapid due to persistent easterly winds. The ice edge was situated 250 km east of St. John's when the ship sailed on March 15. By March 19, the ice cover had been reduced to a 60 km band along the Newfoundland coast. Pages 9 to 11 show ice conditions for March 15, 18 and 22 (supplied by Ice Center Canada).



Ice condition for March 15, 1987



Ice condition for March 18, 1987

Ice condition for March 22, 1987

5. Meteorological data

5.1 Minimet

A meteorological buoy, Minimet, was deployed at 45° 46.44'N, 51° 53.05'W (see p.12 for location) on March 18. This instrument records wind speed,wind direction, air temperature, sea surface temperature and maximum wind speed. The sampling interval is 1 s. The hourly outputs consist of averages of the first ten minute's data for air temperature, sea surface temperature and wind vector, and the maximum of the first ten minute's wind speed.

Raw data, 6-hour box-car filtered date, and progressive vecoter diagram for wind are shown in pp.13 to 15.

Julian day is used in all time sereis plots in this report. The conversion between Julian day, and month and day of month is given in an appendix.

5.2 Land stations

Meteorological data from St. John's and Cape Race were obtained from the Atmospheric Environment Service. Hourly wind speed, wind direction, air temperature, dew point and barometric pressure are shown in pp.16 to 17.

5.3 Pressure buoy

Two buoys measuring sea level barometric pressure and sea surface temperature manufactured by Hermes Electronics Ltd. were moored on the Southeast Shoal (#2484, 44° 14.40'N, 50° 4.80'W) and the St. Pierre Bank (#2481, 45° 8.28'N, 55° 47.70'W, see p.12 for location).

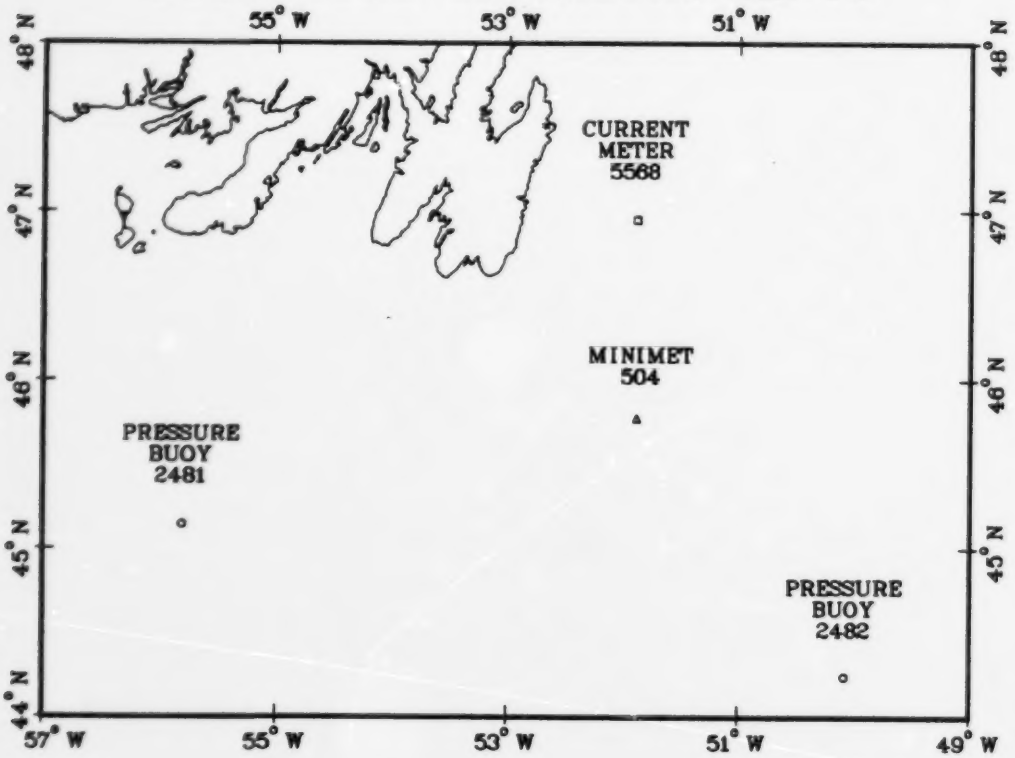
Pages 18 and 19 show time series plots of pressure and sea surface temperature from the two buoys.

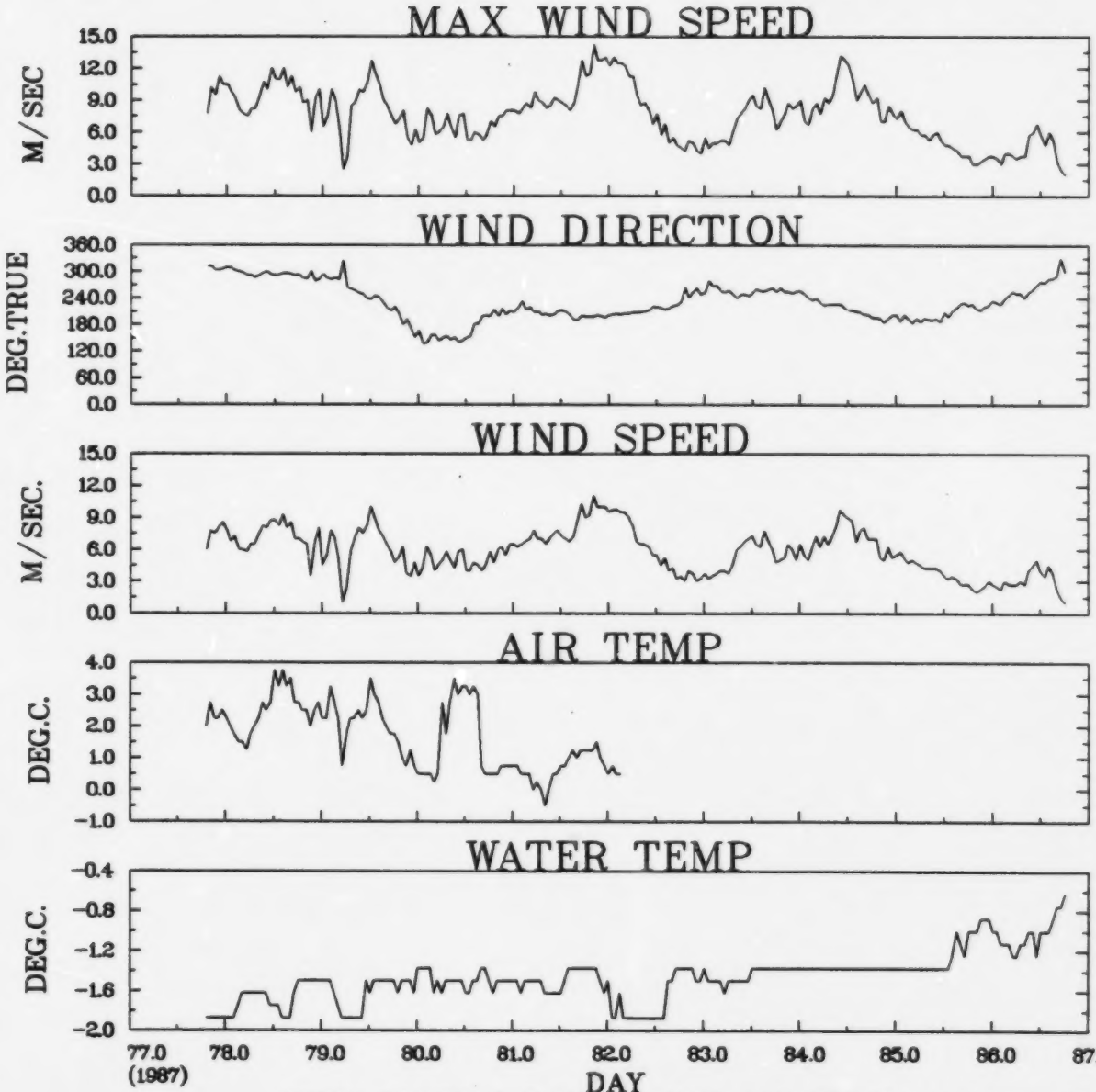
5.4 Gridded wind field

Winds over the northwestern Atlantic were produced by MacLaren Plansearch Ltd. (1988) using all available meteorological data and a boundary layer model. The grid spacing is 1.25^0 latitude and 2.5^0 longitude. In a sub-area extending from 43.75^0N to 53.75^0N and from 42.5^0W to coast, a finer grid with half of the grid size of the coarse grid was used. Pages 20 to 28 show wind vectors in the southern marginal ice zone using the fine-grid data of Plansearch Ltd.. The vectors give the wind speed and direction "to".

To compare the gridded wind with the Minimet wind, time series plots of wind speed and direction at 6 grid points (see p.29 for location) around the Minimet site are shown in pp.30 to 35.

LOCATIONS OF INSTRUMENTS





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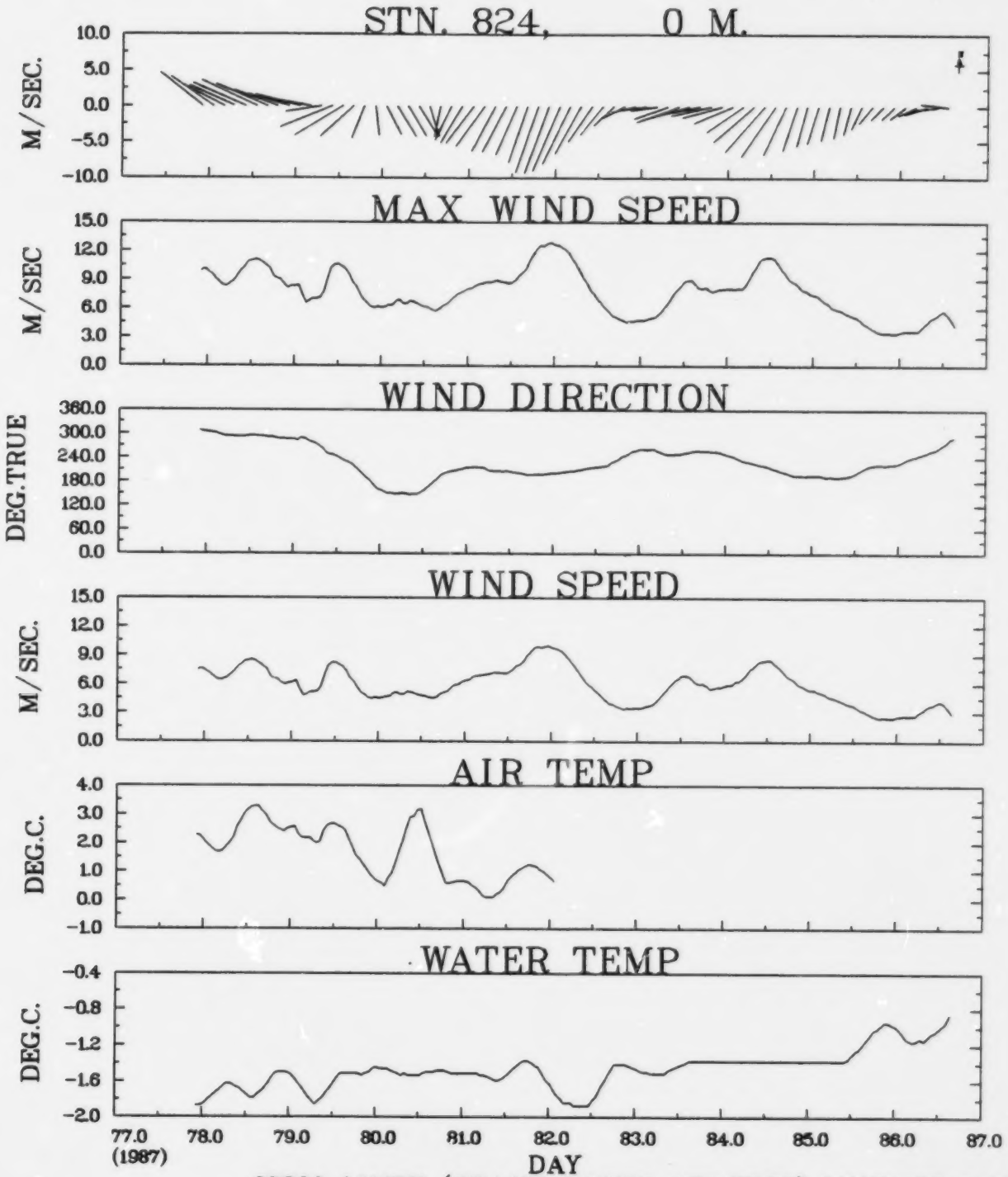
504 MAR 18-27 1987

INST. 504



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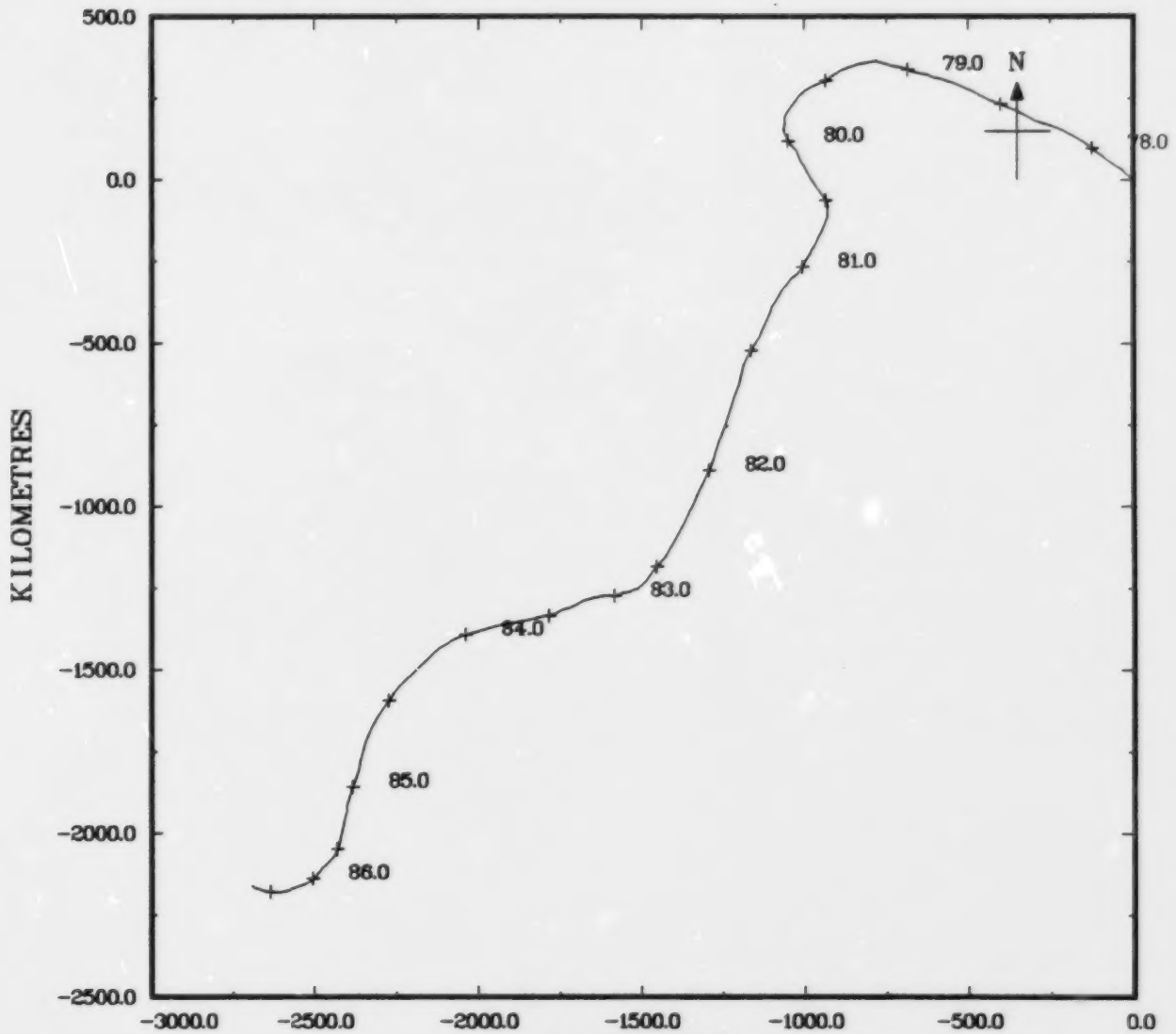

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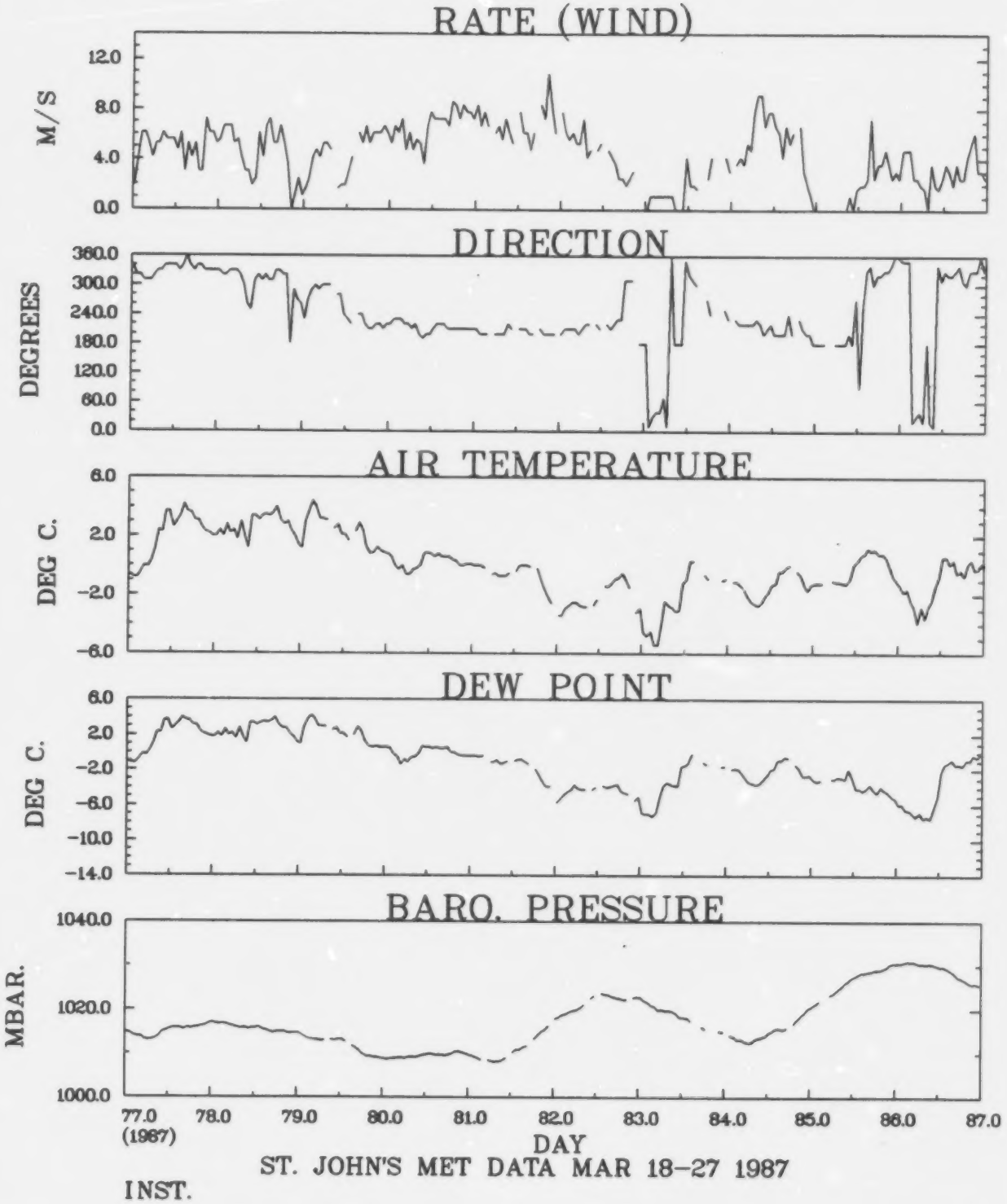

ST. JOHN'S MET DATA MAR 18–27 1987

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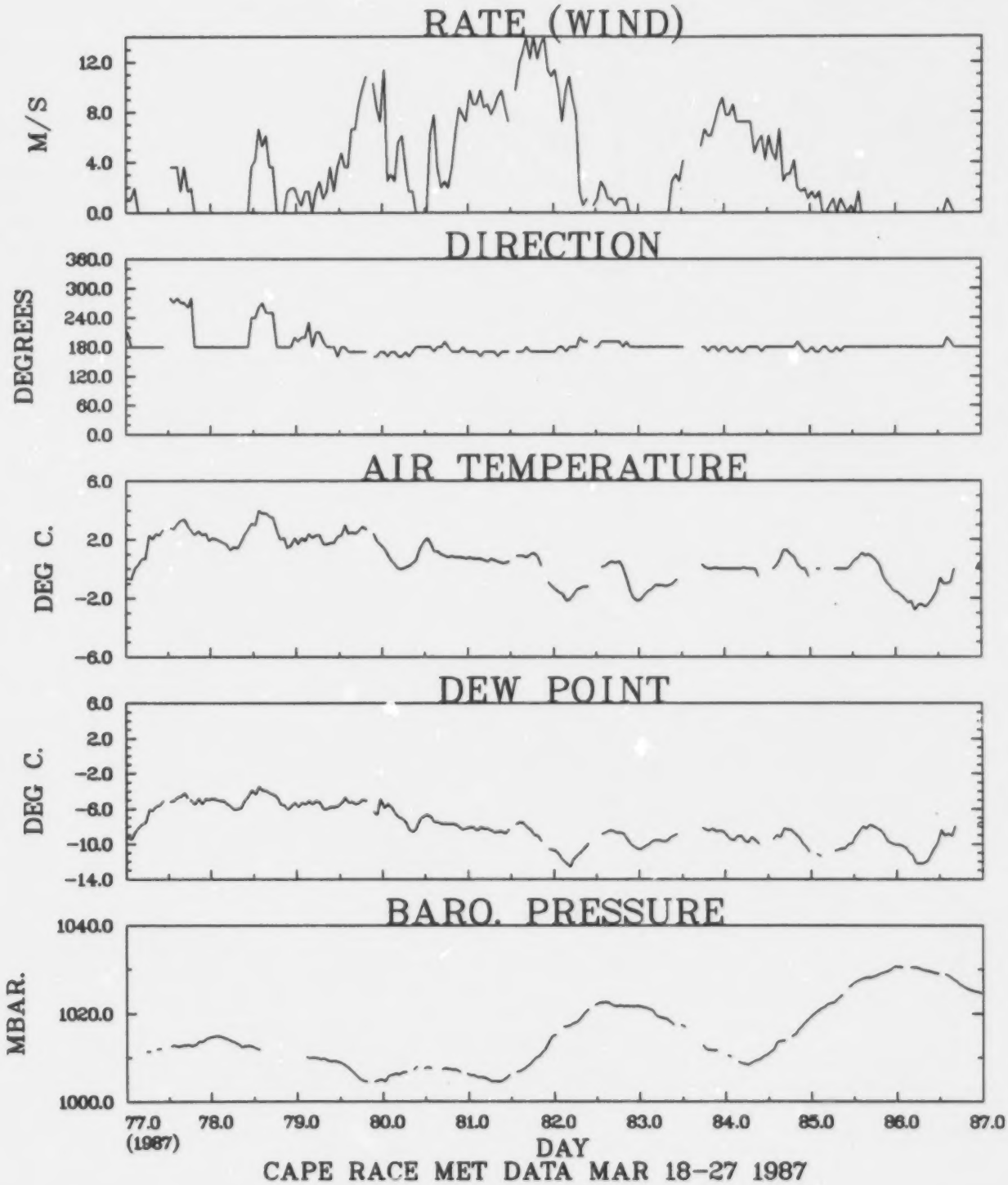
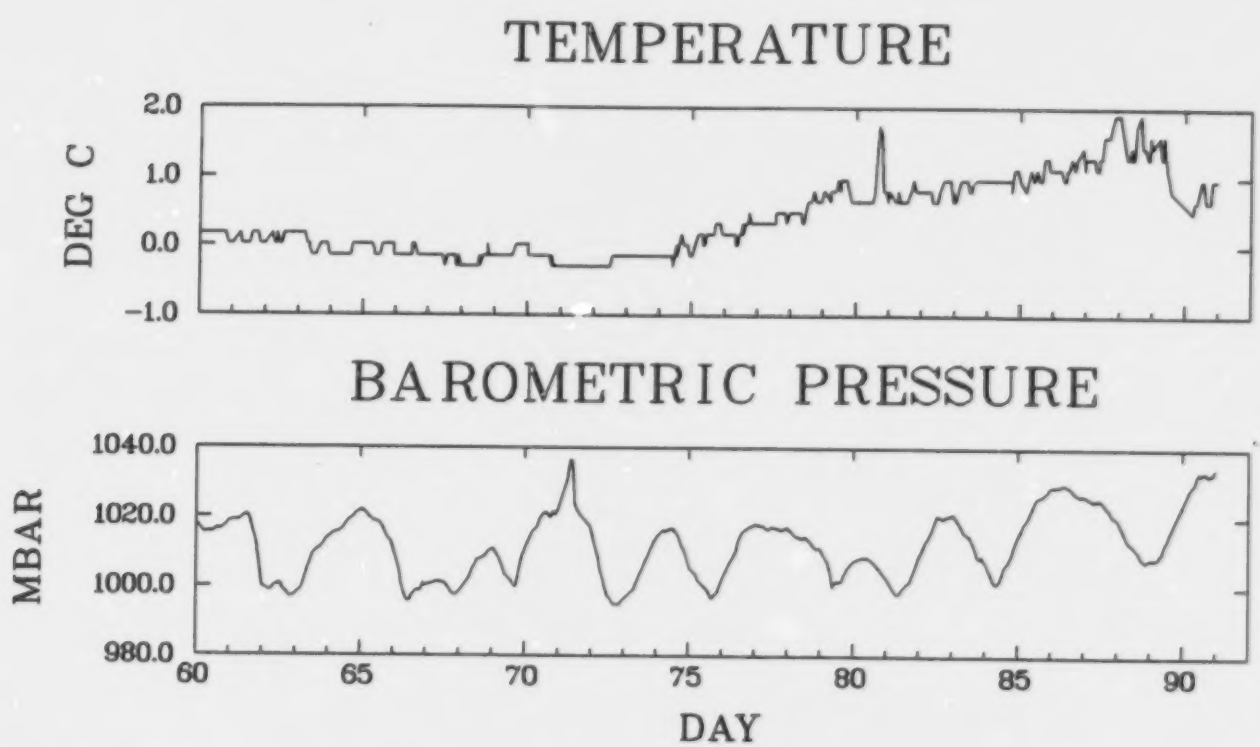
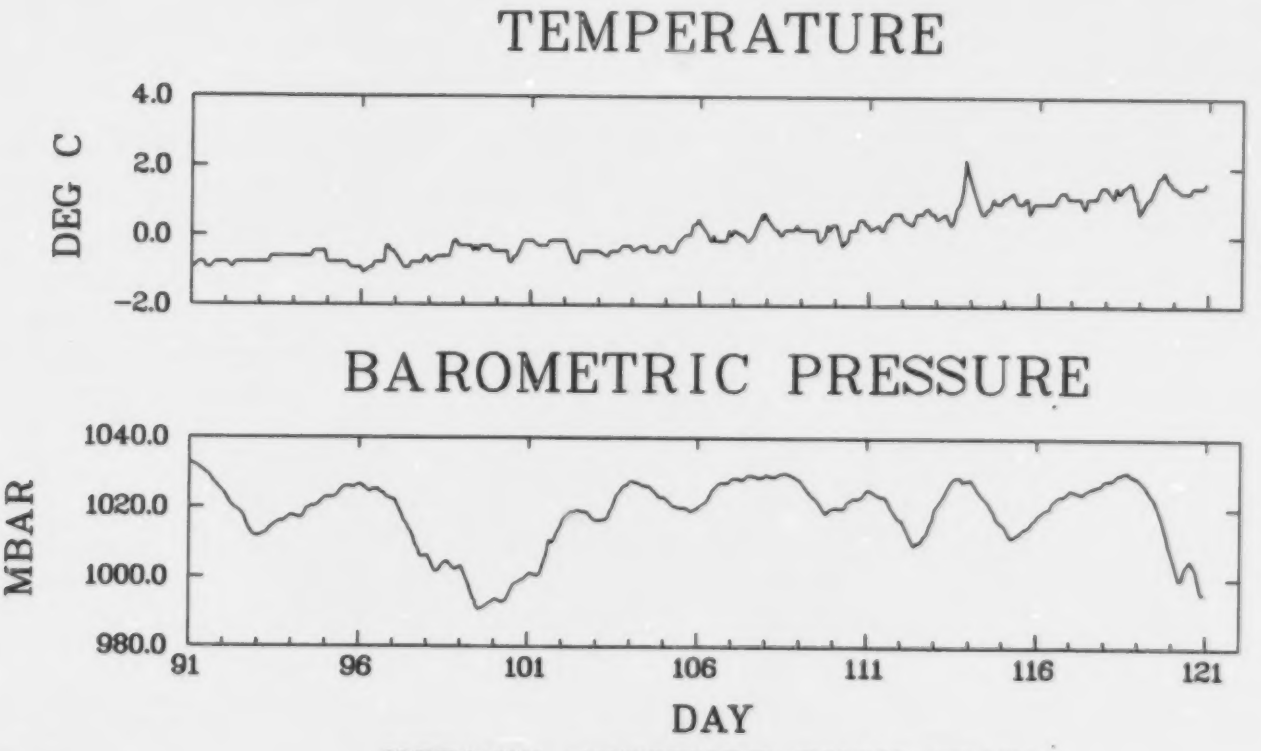
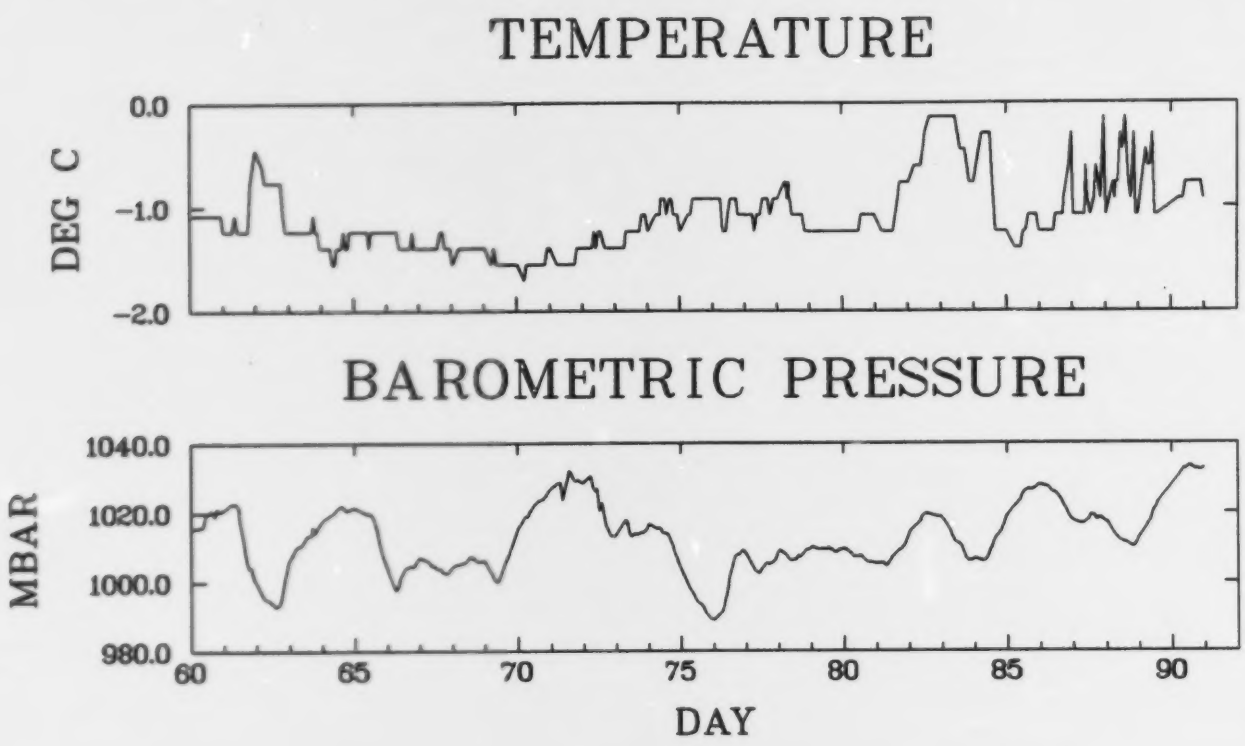


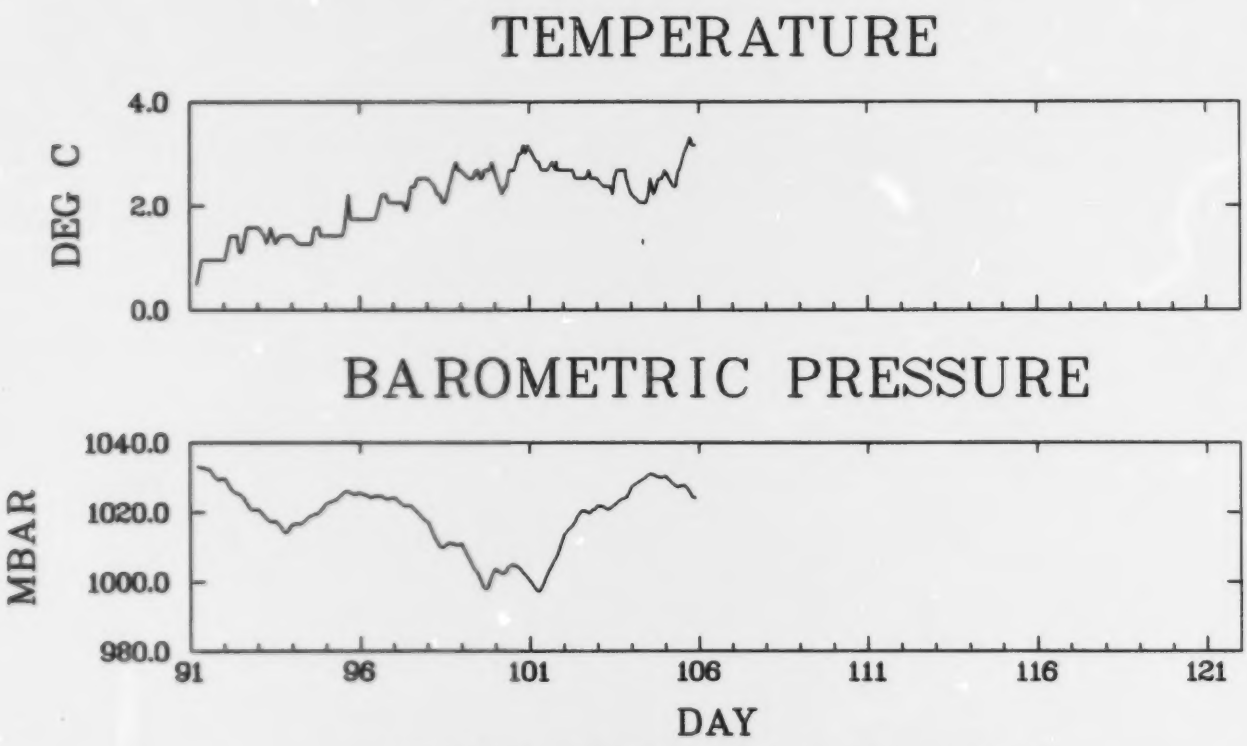
CAPE RACE MET DATA MAR 18-27 1987





HERMES PRESSURE BUOY #2481





HERMES PRESSURE BUOY #2482

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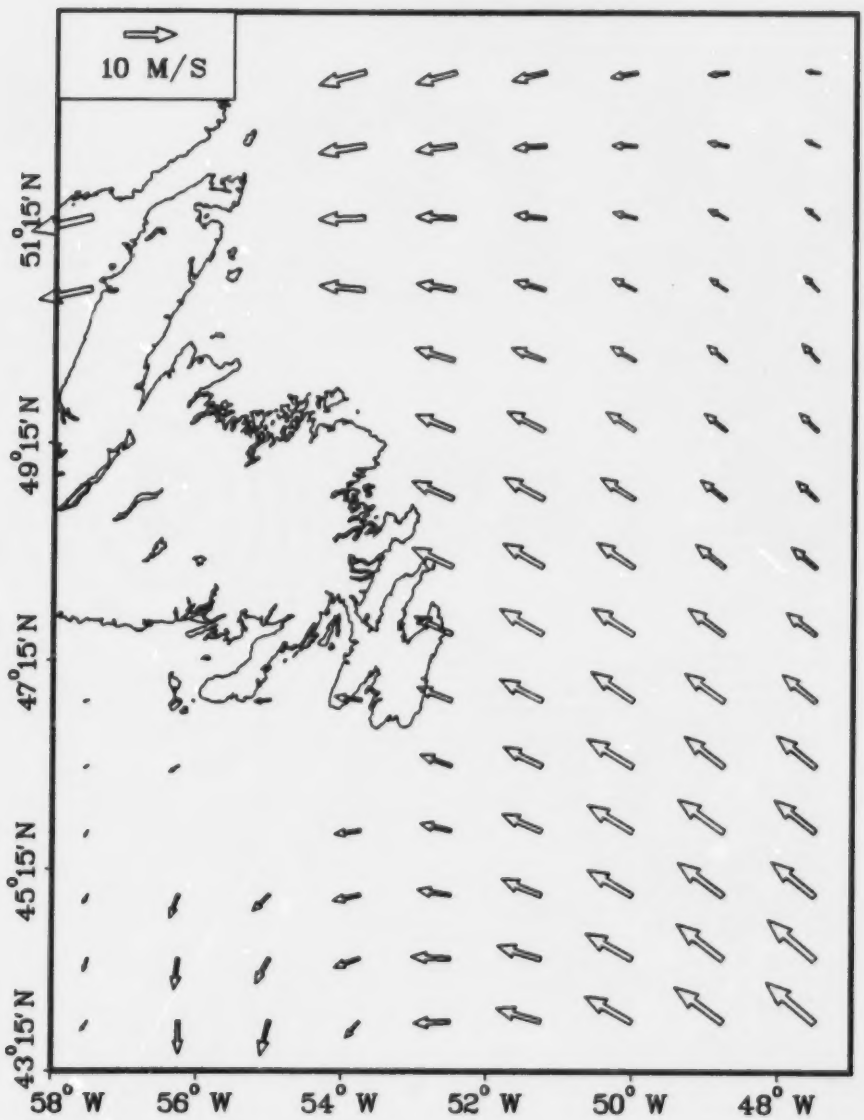

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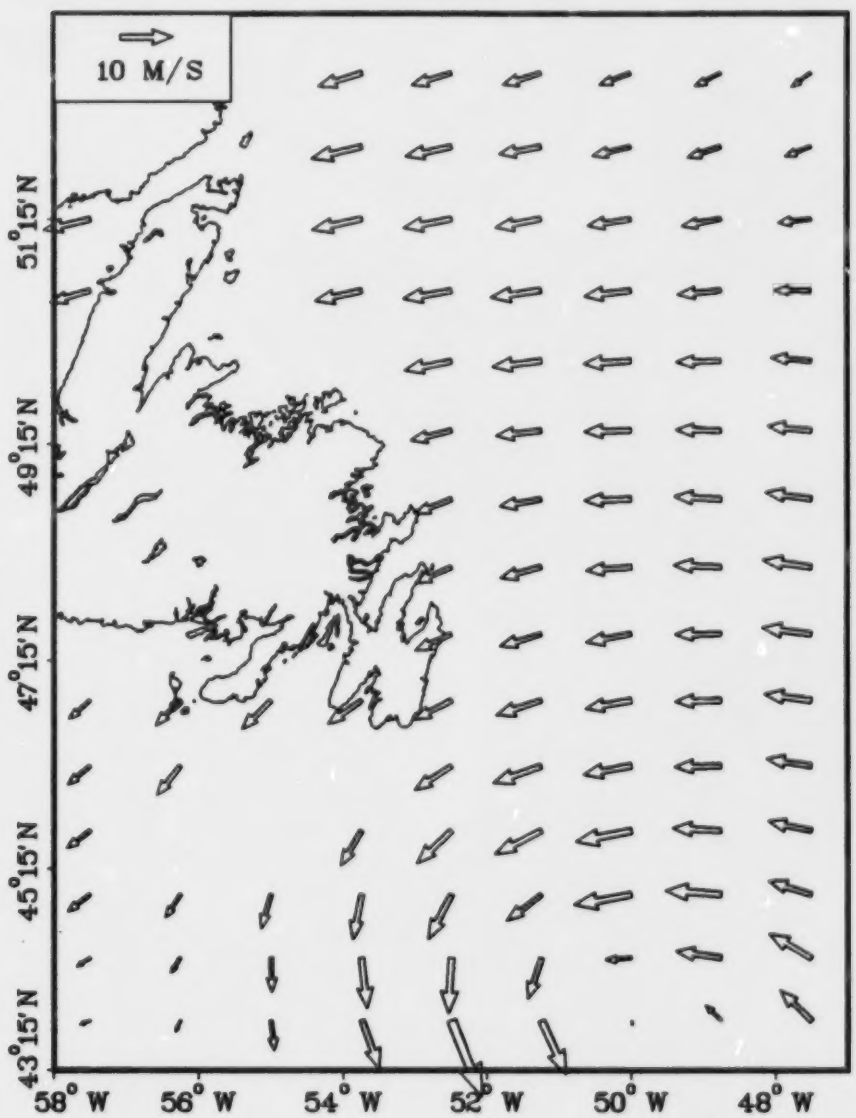

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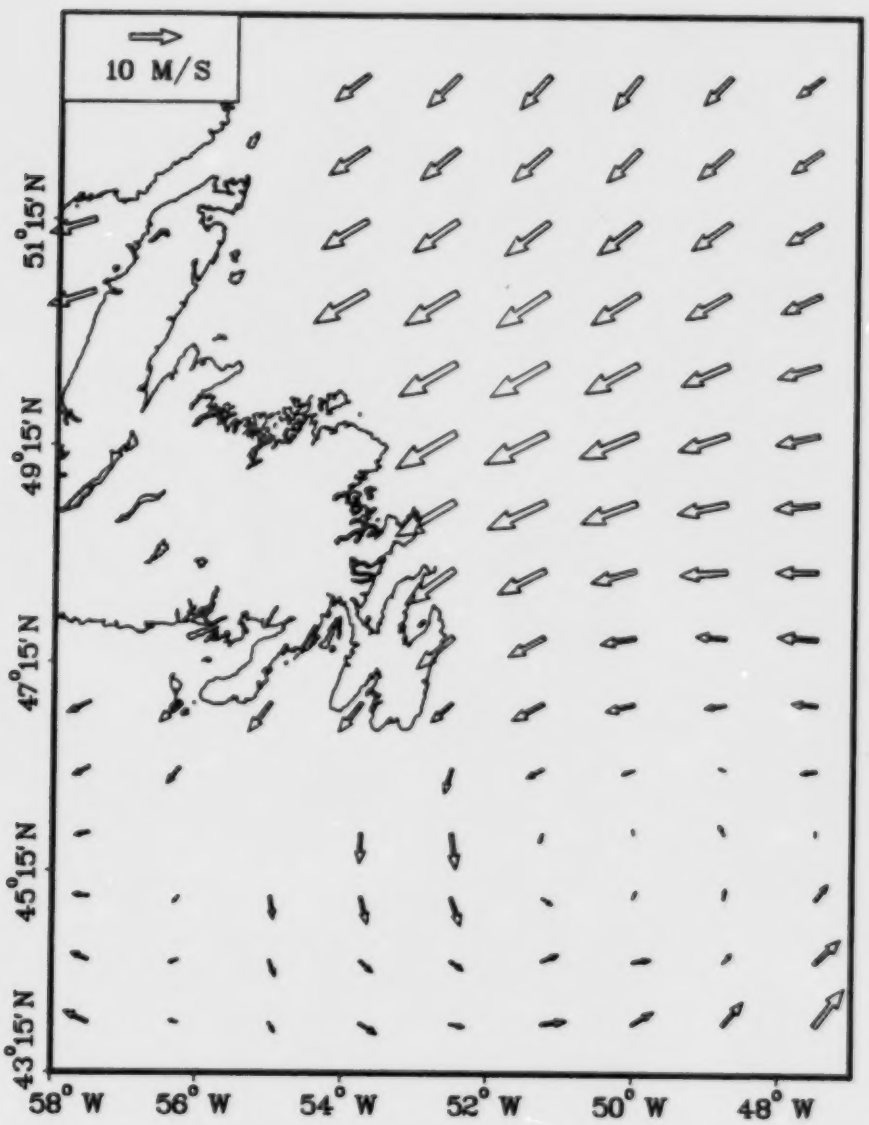

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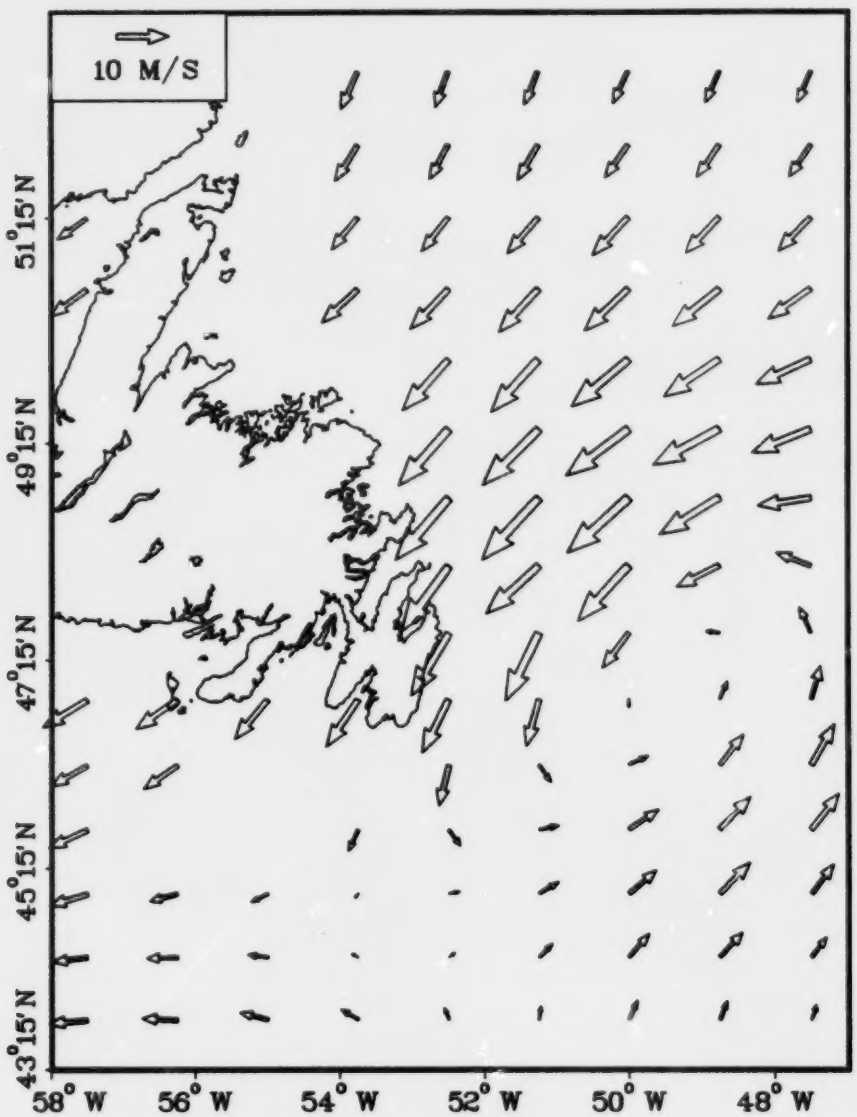

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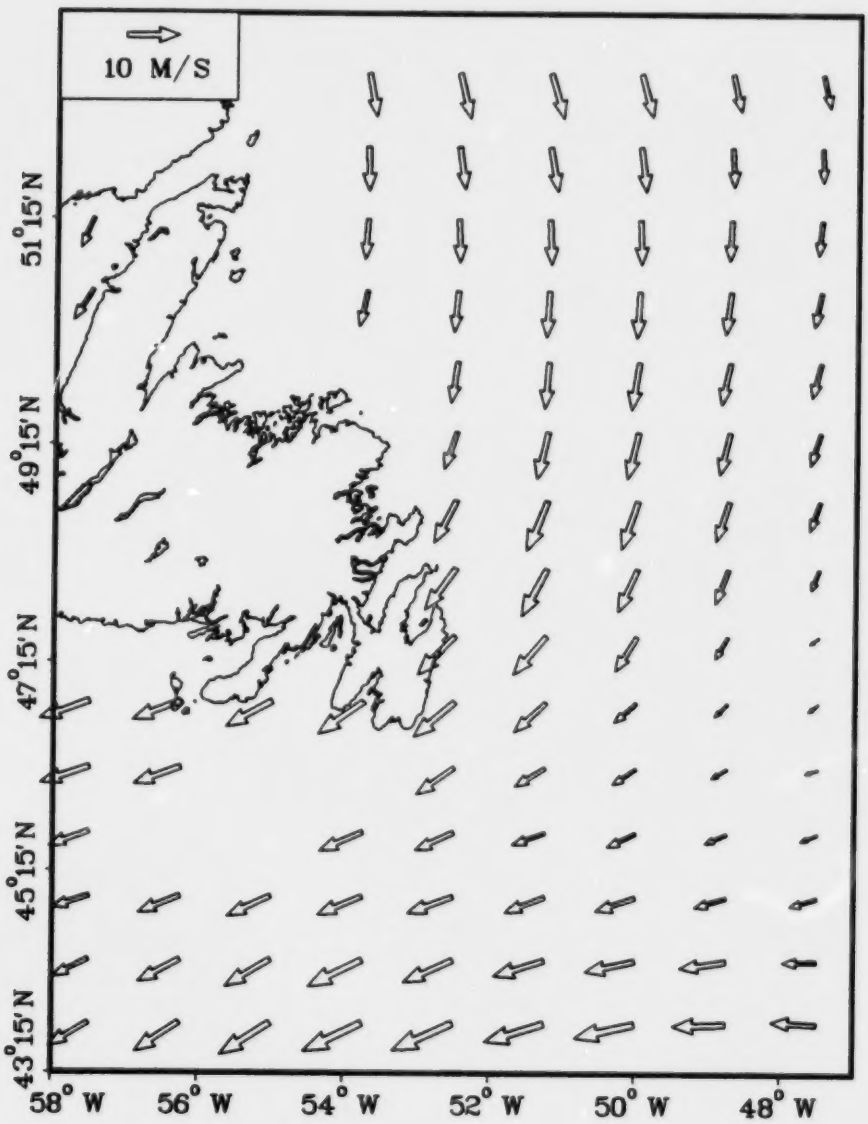

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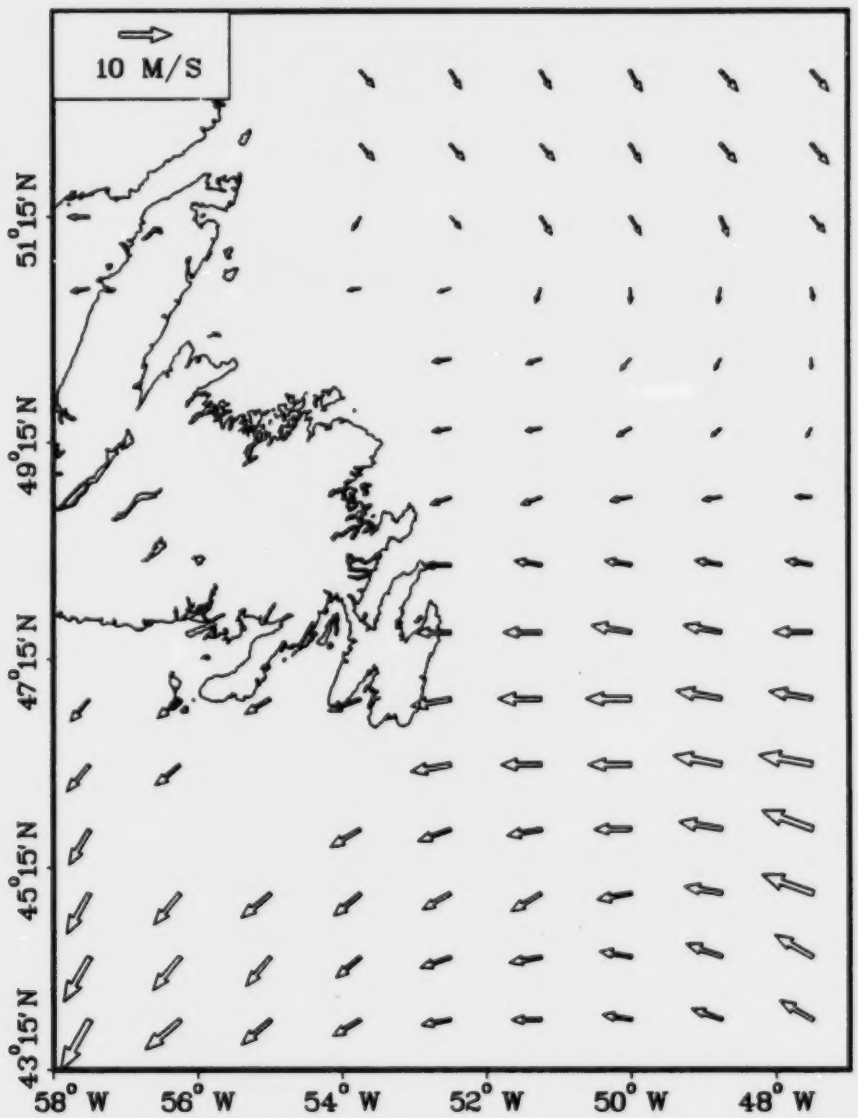

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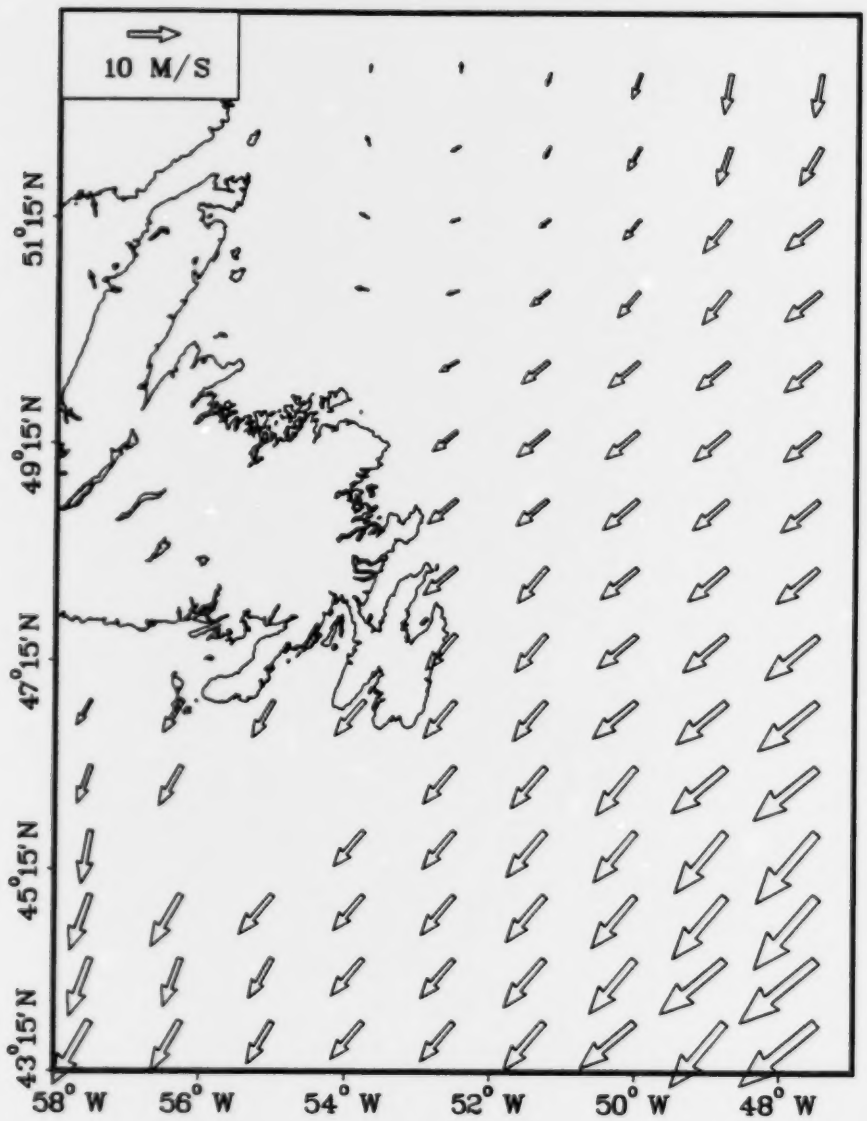

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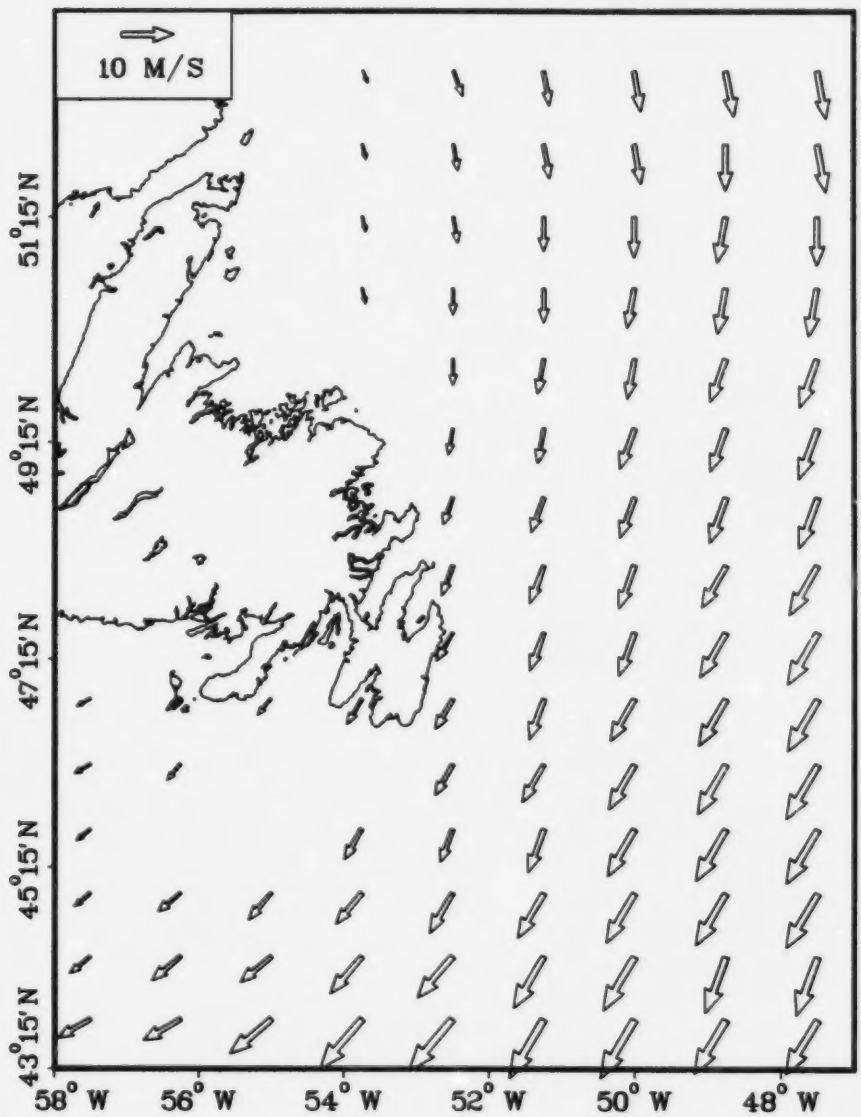

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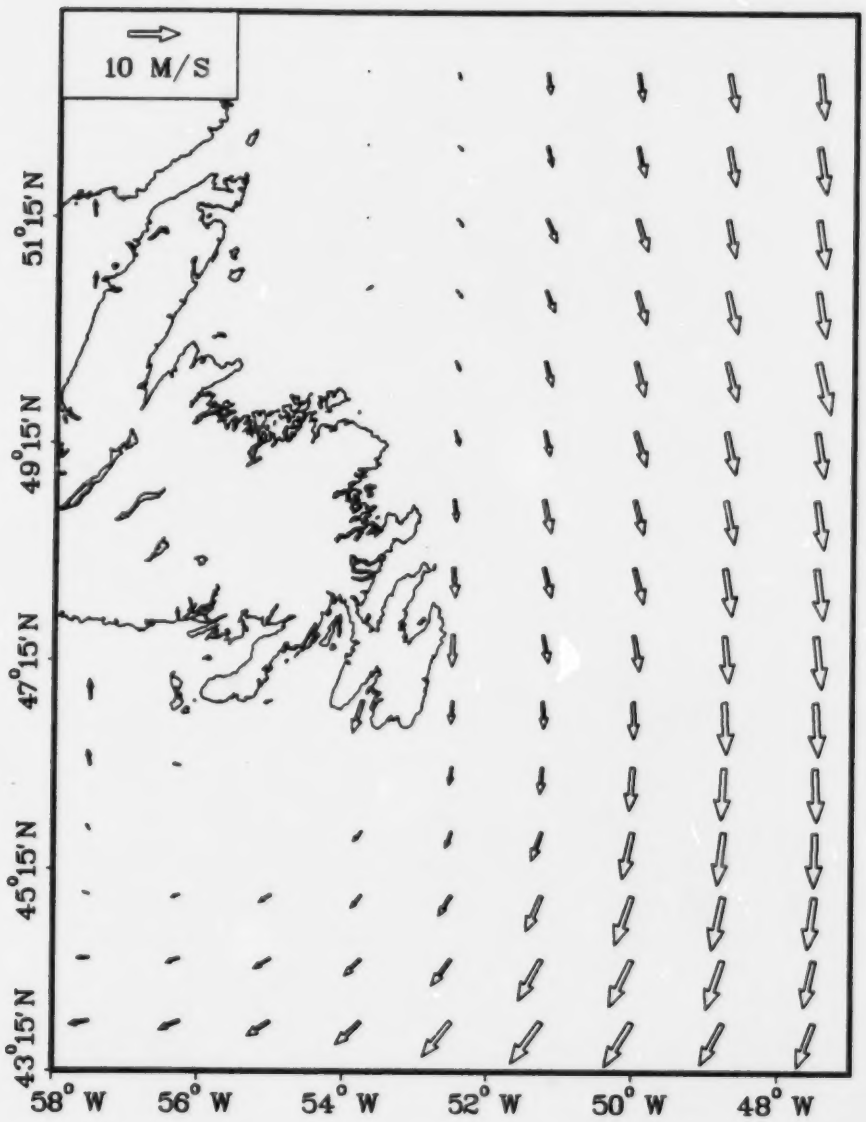
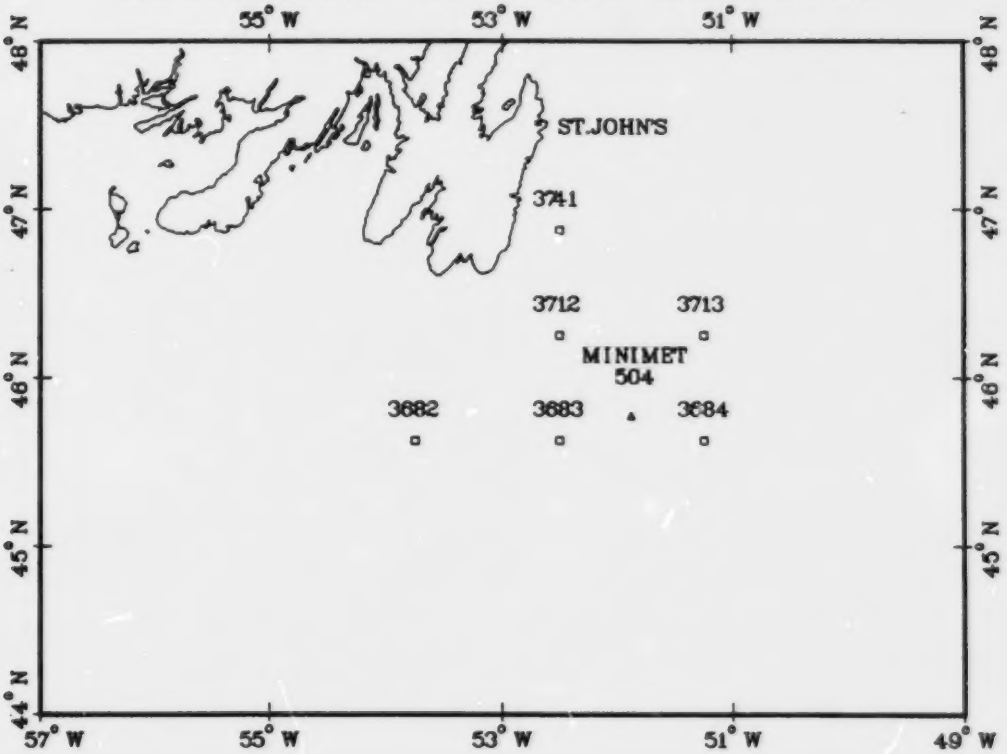
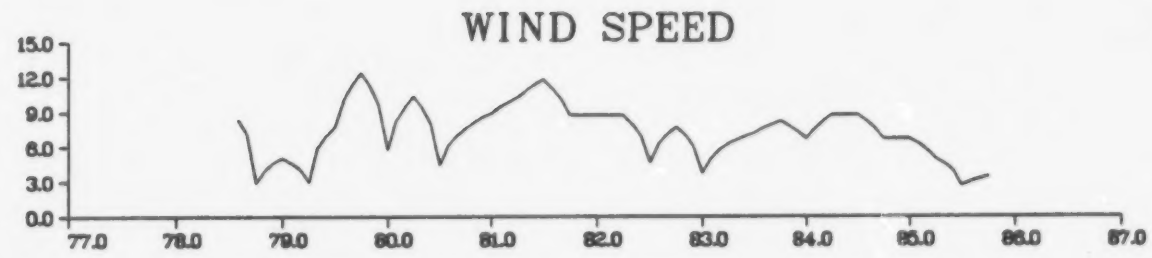
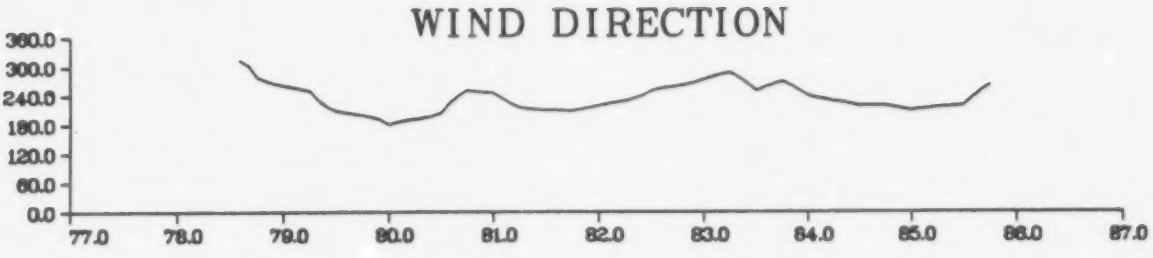


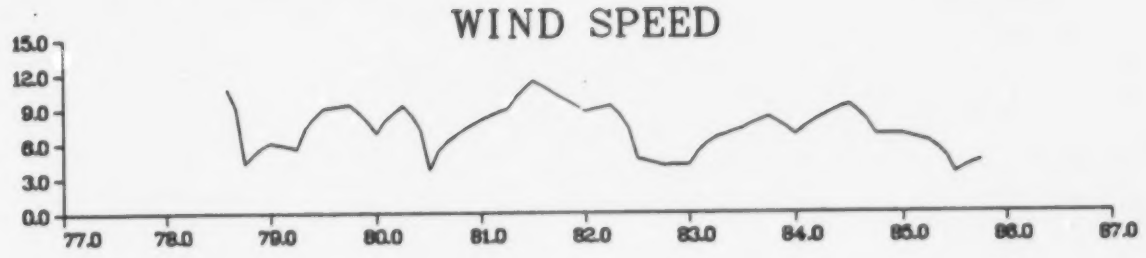
LOCATIONS OF WIND STATIONS

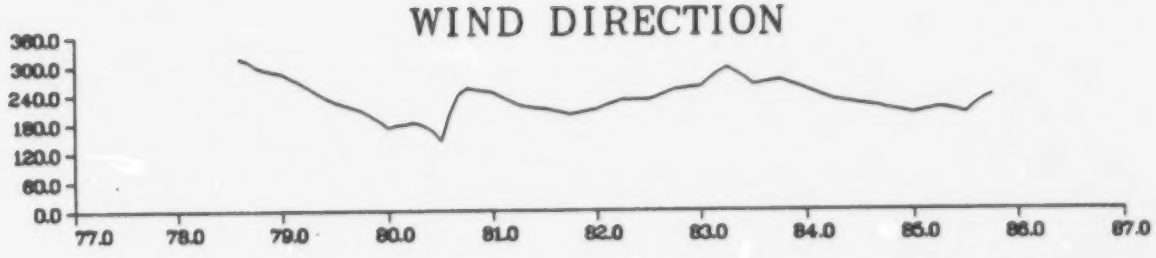




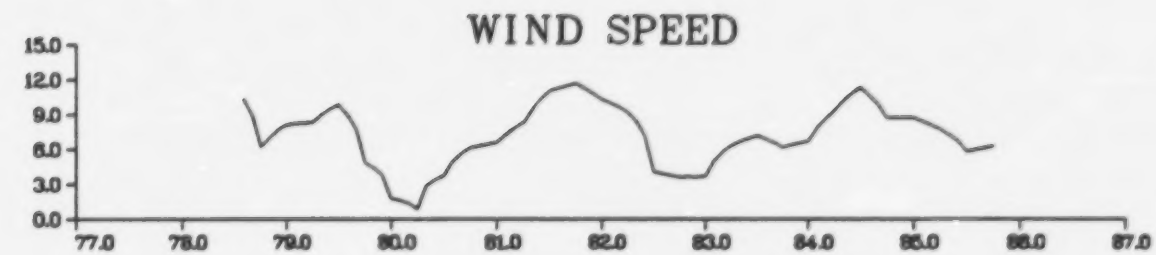


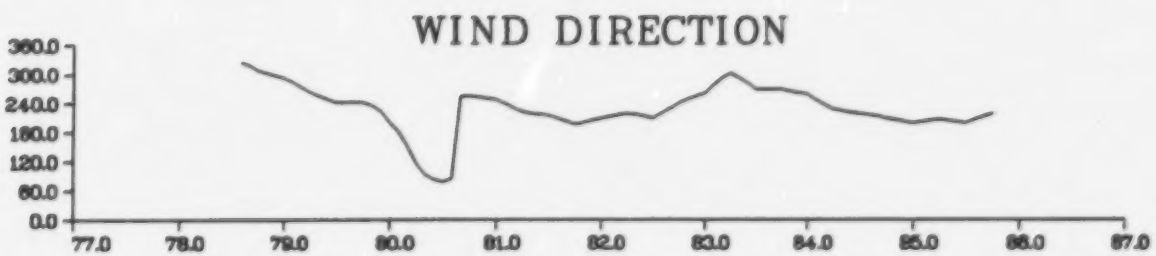
Grid point 3682



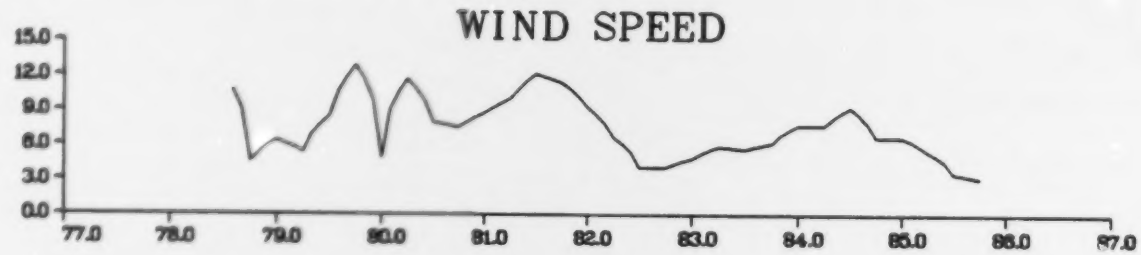


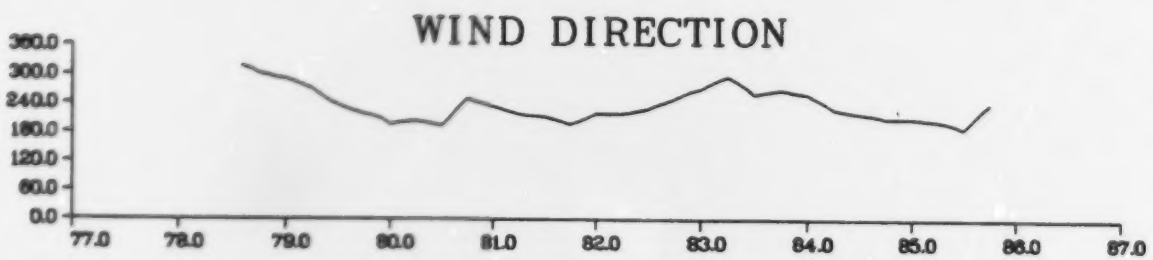
Grid point 3683



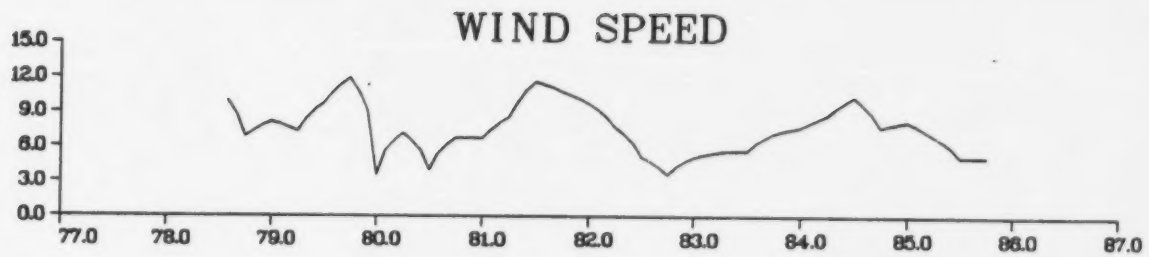


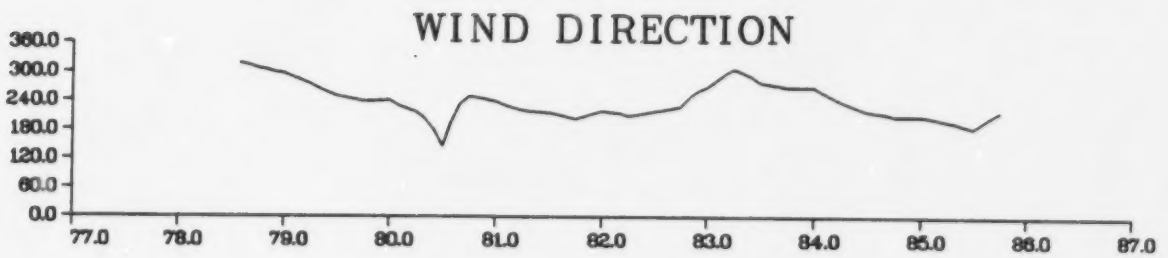
Grid point 3684



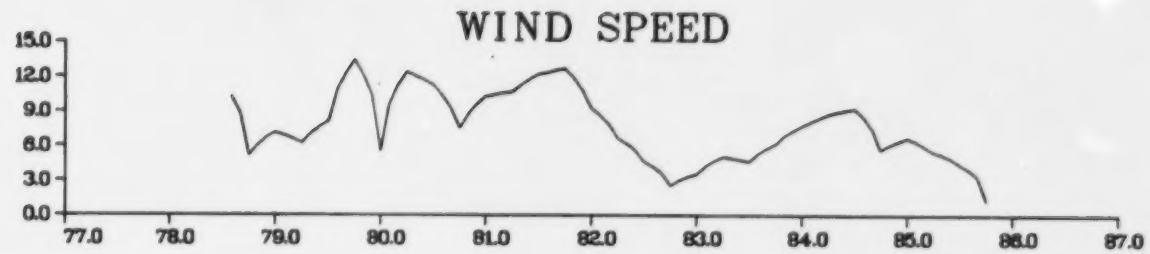


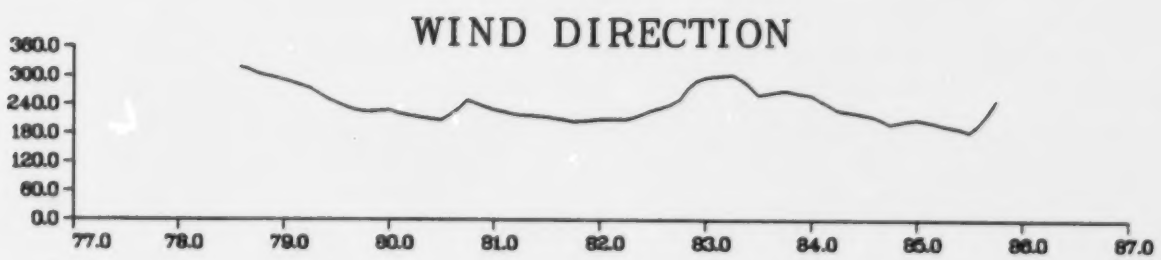
Grid point 3712





Grid point 3713

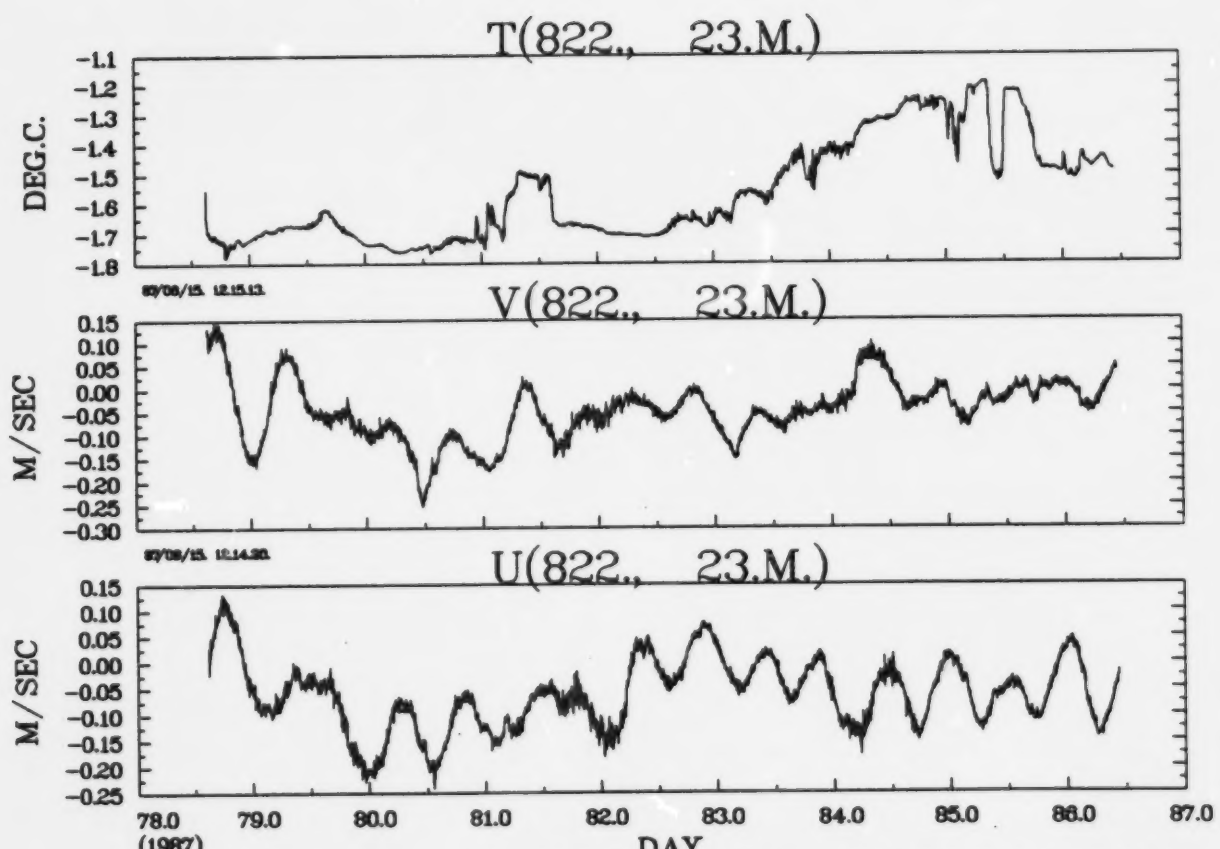




Grid point 3714

6. Current meter and thermistor chain data

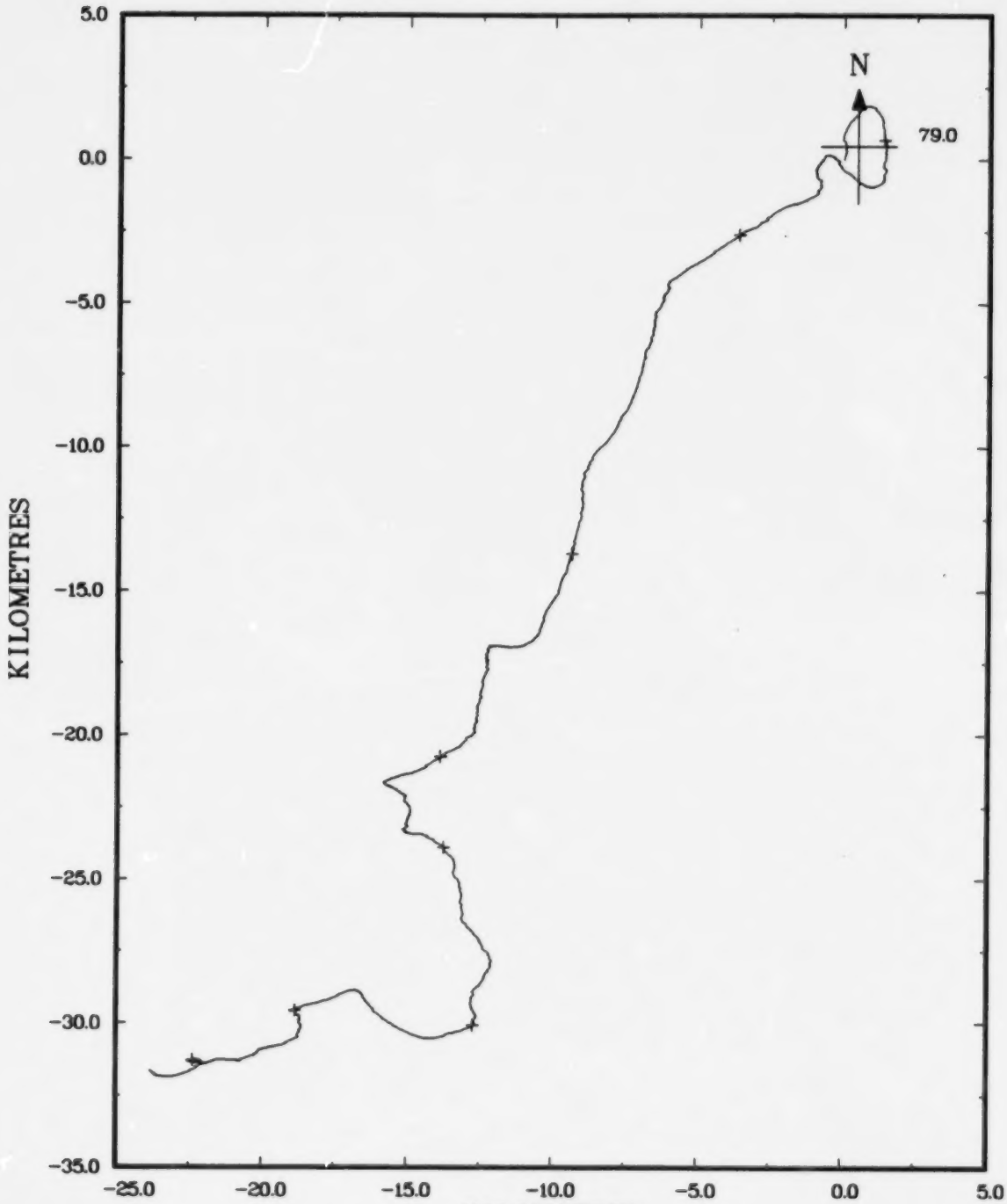
A mooring with a vector averaging current meter at 23m, an Aanderaa current meter at 33m, and a thermistor chain with 11 thermistors at 3m interval from 33 m to 64 m was laid at 46^0 57.10'N, 51^0 53.00'W (see p.12 for location). Pages 37, 39 and pp.41 to 42 show time series plots of the parameters measured by the current meters: T-temperature, S-salinity, U-east component of velocity, V-north component of velocity, R-speed, D-direction. The title of each plot gives the parameter name, mooring number and instrument/sensor depth. Pages 38 and 40 show the progressive vector diagrams of the currents.



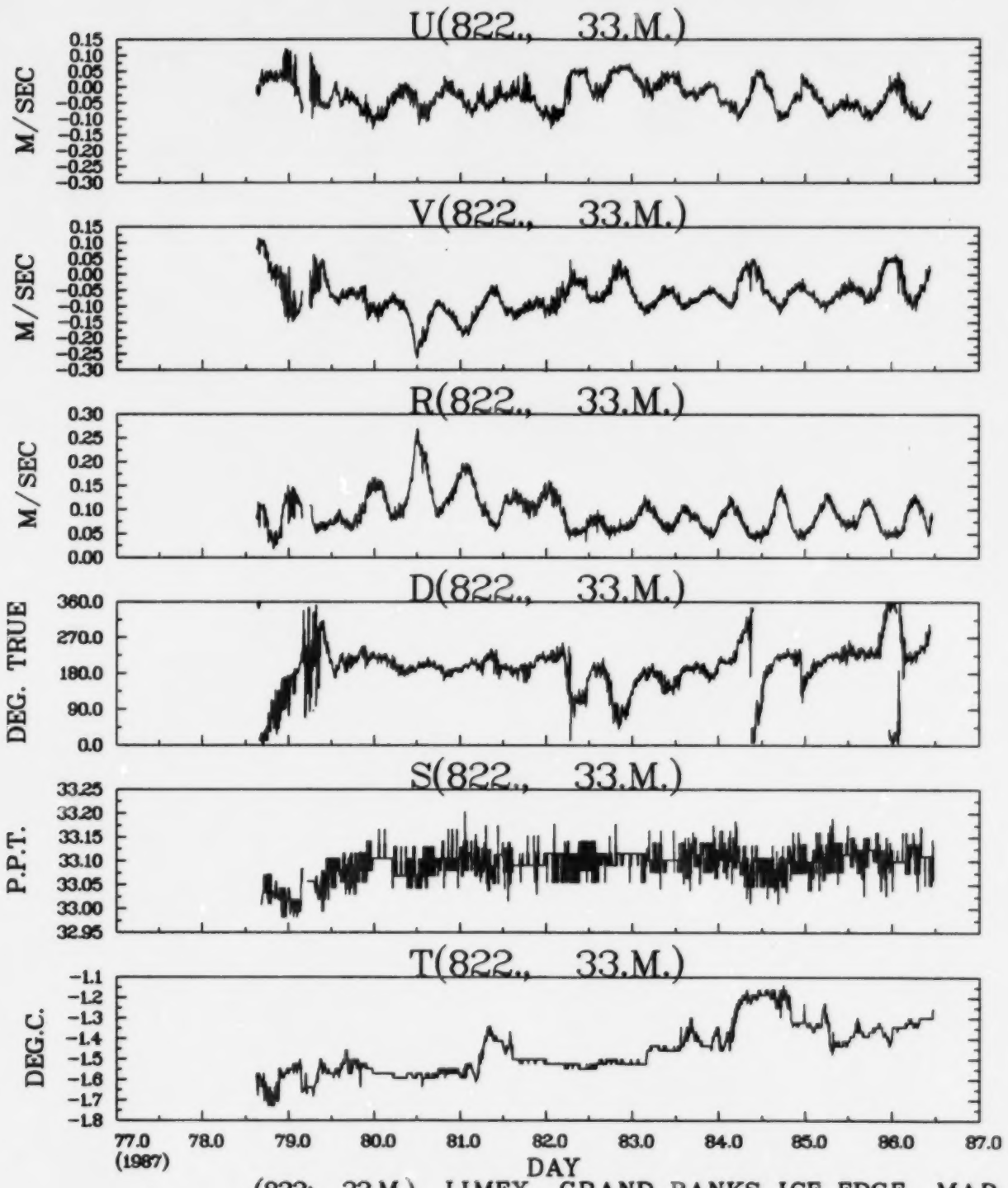
87002 LIMEX (GRAND BANKS ICE EDGE) VACM 0497
MAR 19–27 1987 (C.TANG)

INST. V0497

STN. 822, 23 M.



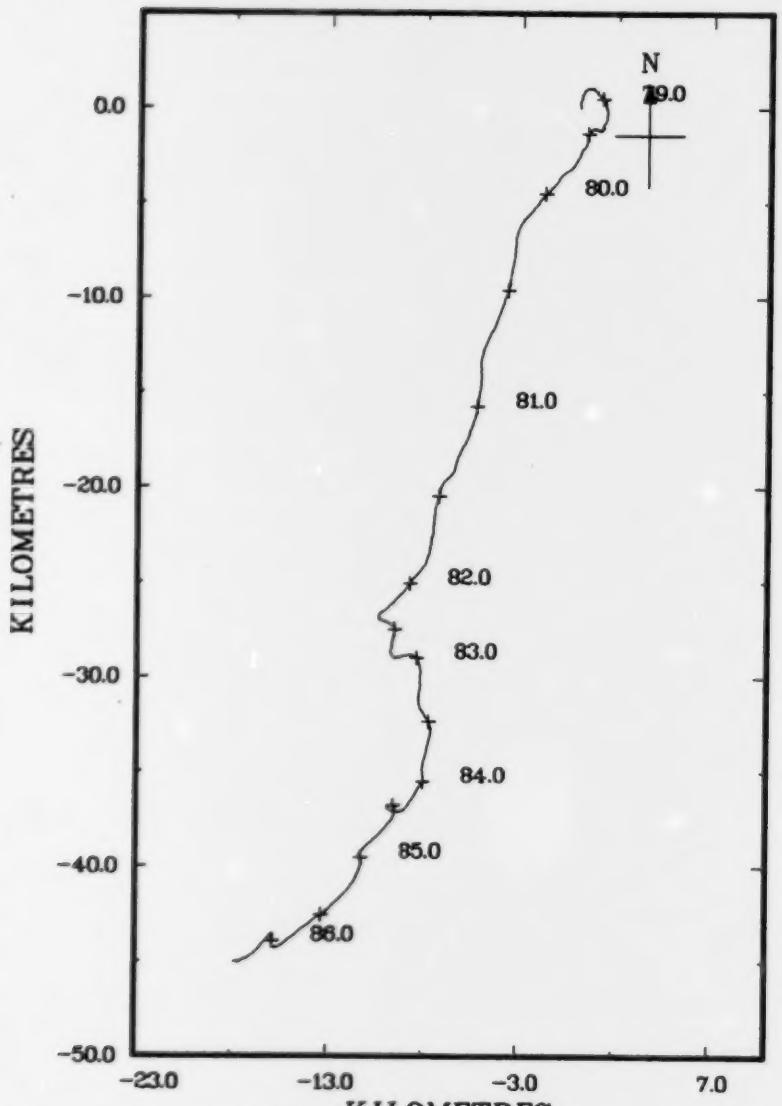
87002 LIMEX (GRAND BANKS ICE EDGE) VACM 0497
MAR 19-27 1987 (C.TANG)
INST. V0497



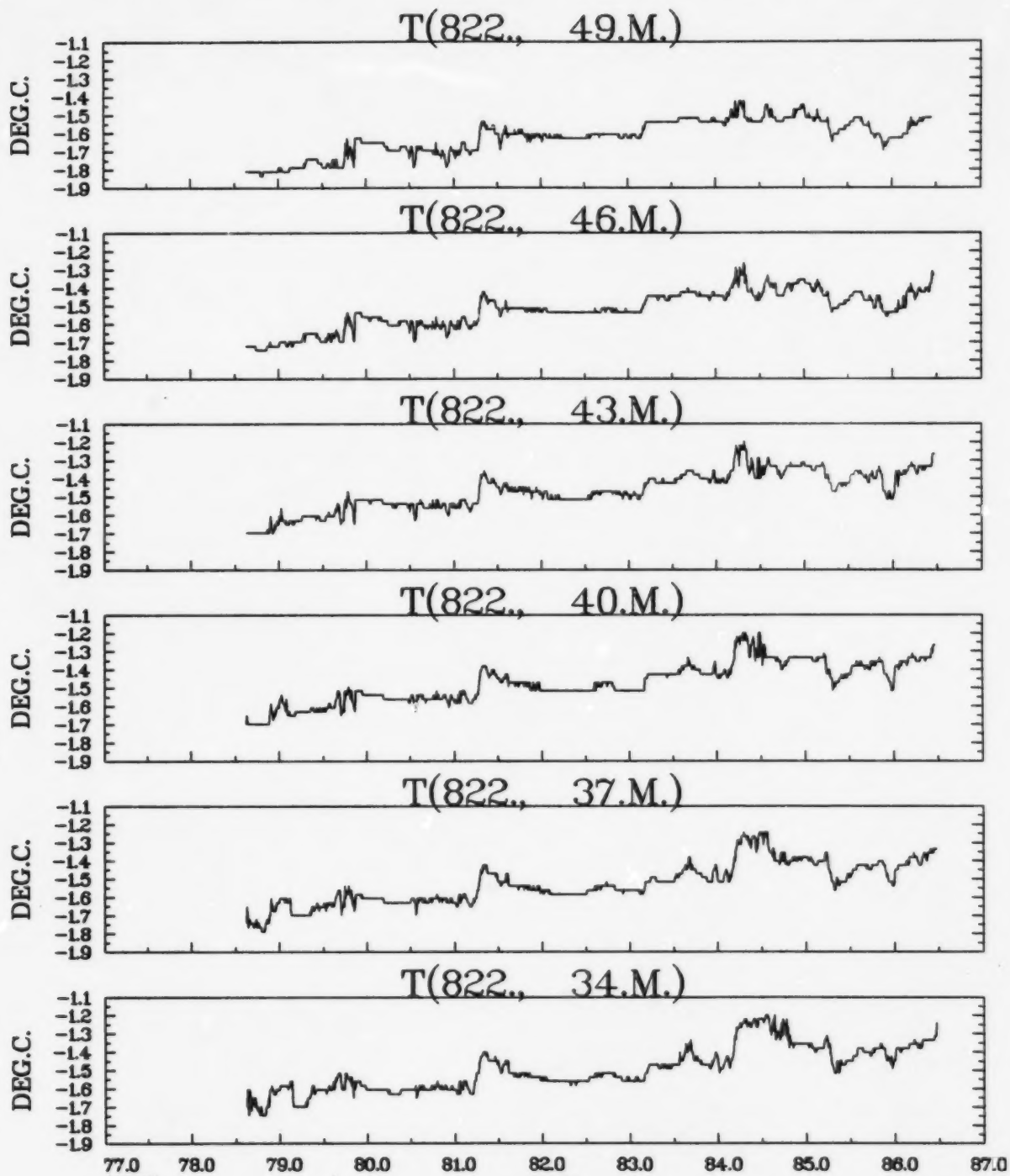
(822; 33.M.) LIMEX GRAND BANKS ICE EDGE MAR 19–27 1987 (C.TANG)

INST. 5568

STN. 822, 33 M.

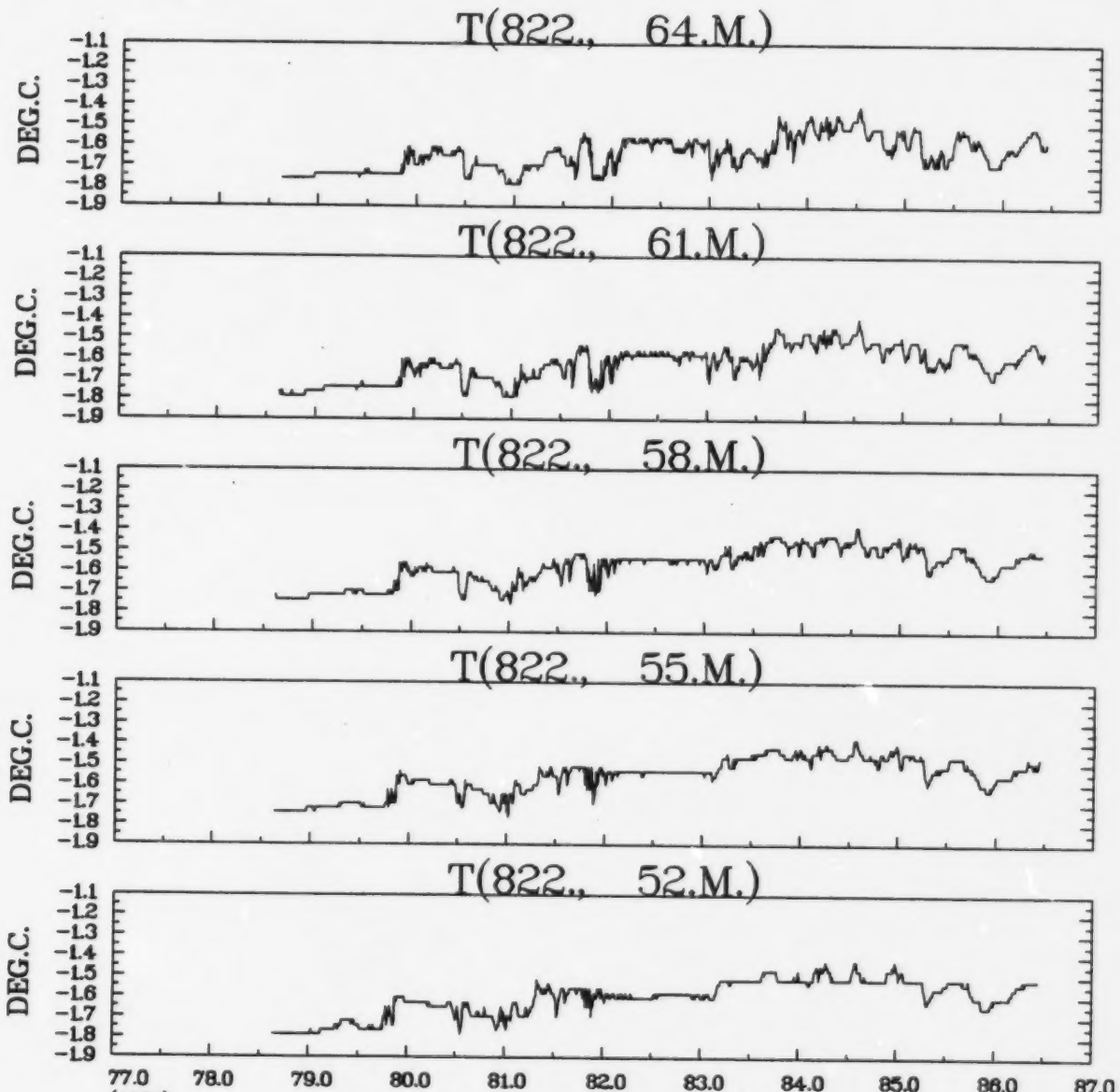


(822; 33.M.) LIMEX GRAND BANKS ICE EDGE MAR 19-27 1987 (C.TANG)
INST. 5568



(822; 34.M.) LIMEX GRAND BANKS ICE EDGE MAR 19–27 1987 (C.TANG)

INST. 0407



(822; 34.M.) LIMEX GRAND BANKS ICE EDGE MAR 19–27 1987 (C.TANG)

INST. 0407

7. Temperature/salinity data from oceanographic stations

7.1 Shipboard CTD

Ninety CTD stations were occupied. With the exception of Station 1, all CTD casts were conducted in the open water. Station 1 was located in a lead inside the pack ice about 8 km east of St. John's. The locations, start times and water depths of the stations are given in pp.45 to 47. The times are in GMT, and water depths are in meters.

The data were routinely processed at B.I.O.. Calibration of the data against bottle samples show that data from Stations 9-25 are in error. The cause of the error cannot be determined. Data from these stations are thus not shown. The section designation is given as follows:

Section A - Stations 2-8

Section B - Stations 26-34

Section C - Stations 35-43

Section D - Stations 45-54

Section E - Stations 54-60

Section G - Stations 70-74

Section H - Stations 75-81

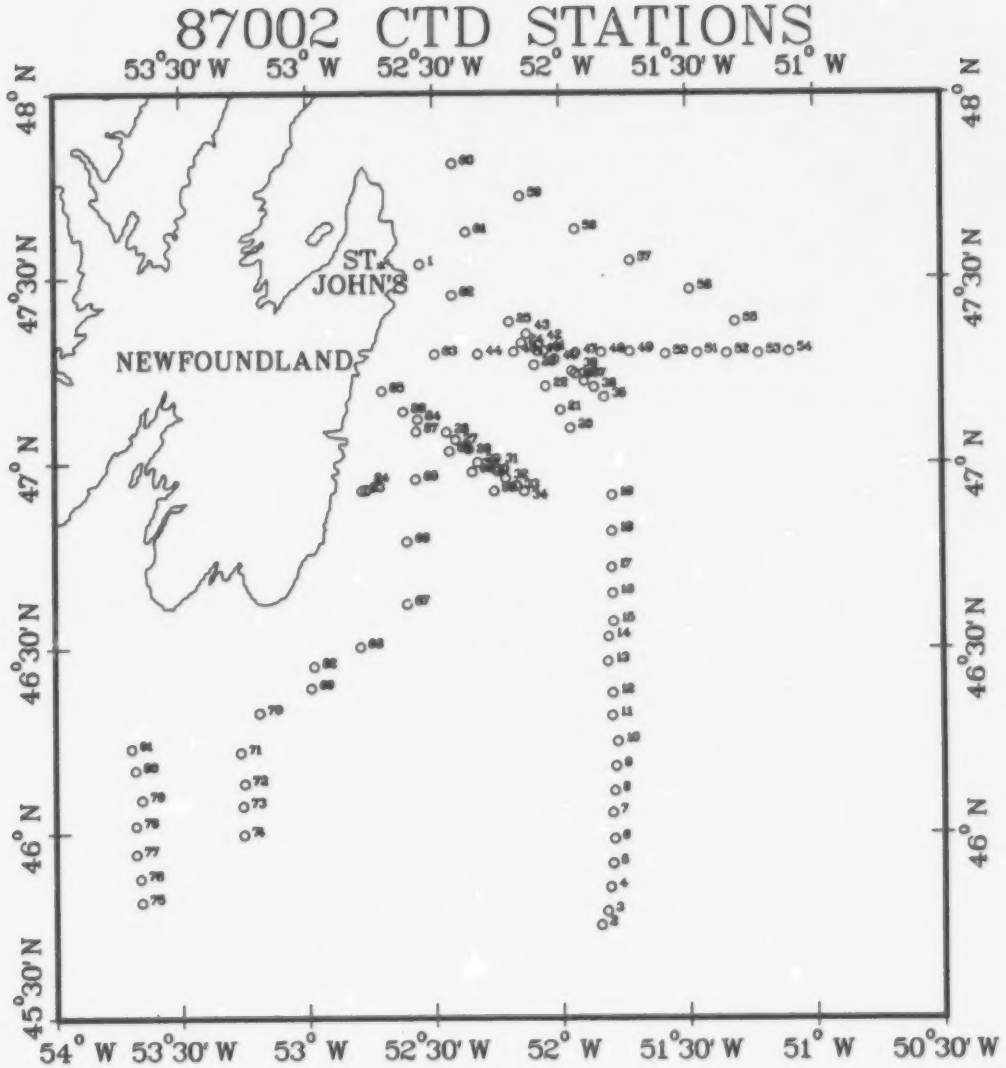
Section I - Stations 86-90

Pages 48 to 55 are section plots of temperature, salinity and σ_t. The stations are arranged in such a way that the left most station is closest to the ice edge. The dash lines above the bottom indicate data limit. Pages 56 to 74 show profiles of the same parameters (down traces only). The station numbers are indicated in the right margin of the pages.

7.2 Temperature/salinity under ice

A portable CTD system consisting of a CTD probe, an electronic unit and a portable winch was used to obtain temperature and salinity data under the ice. The equipment and personnel were deployed from the ship or transported to a remote site by the helicopter carried on the ship. Twenty-five CTD profiles were obtained. The locations of the measurement sites are given in the table and map on pp. 75 and 76.

Temperature, salinity and σ_t profiles (both down and up traces) are shown in pp. 77 to 88.

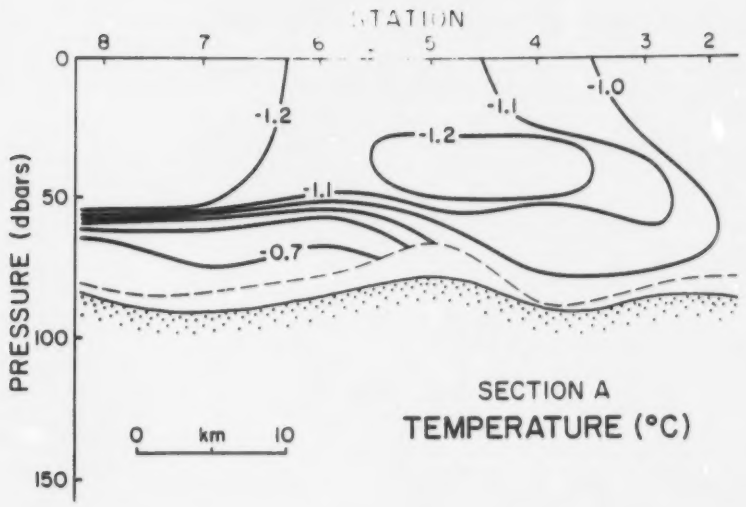

87002 CTD STATIONS
53°30' W
53° W
52°30' W
52° W
51°30' W
51° W
48° N
47°30' N
47° N
46°30' N
46° N
45°30' N
ST. JOHN'S
NEWFOUNDLAND
54° W
53°30' W
53° W
52°30' W
52° W
51°30' W
51° W
50°30' W

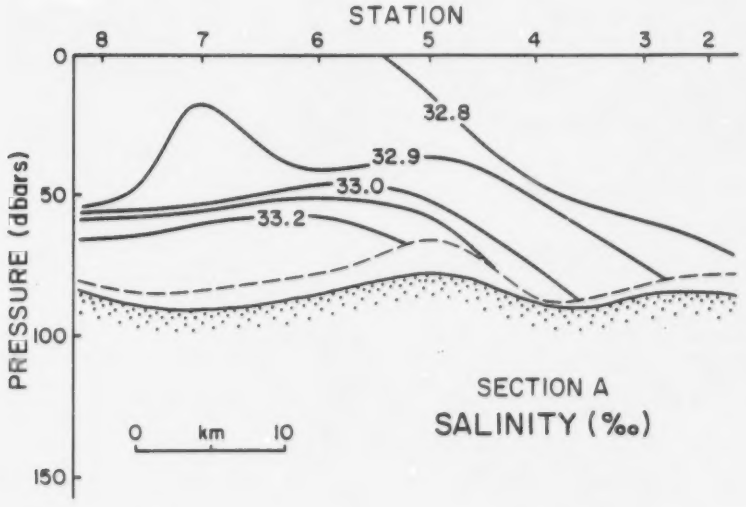
CRUISE 87002 CTD STATIONS

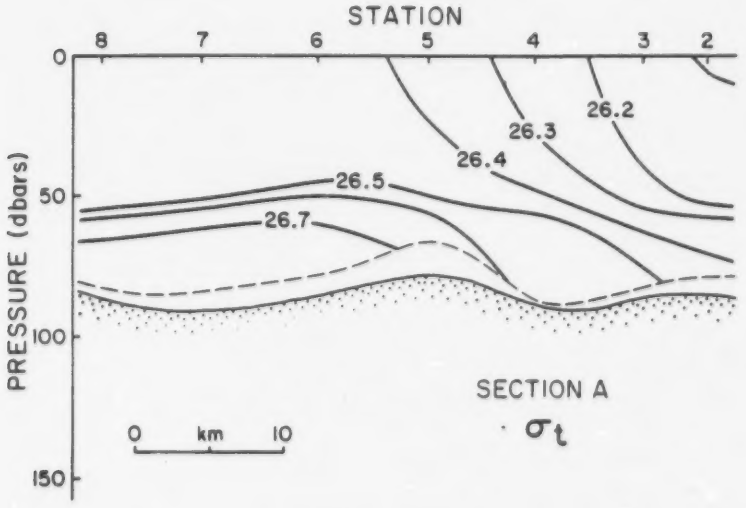
STN	DAY	TIME	LATITUDE	LONGITUDE	WATER DEPTH
1	74	20: 9	47.537	52.552	160
2	77	17:11	45.750	51.850	85
3	77	20:59	45.788	51.825	85
4	77	21:53	45.853	51.813	88
5	77	22:39	45.917	51.803	78
6	77	23:33	45.984	51.796	85
7	78	0:38	46.055	51.803	91
8	78	1:29	46.114	51.794	86
9	78	2:26	46.180	51.788	87
10	78	3:34	46.247	51.781	78
11	78	4:32	46.317	51.802	91
12	78	5:30	46.378	51.800	102
13	78	6:32	46.463	51.818	107
14	78	7:21	46.530	51.815	106
15	78	8: 1	46.571	51.795	109
16	78	8:40	46.647	51.798	106
17	78	9:23	46.717	51.801	107
18	78	10:34	46.815	51.800	115
19	78	11:35	46.912	51.798	
20	78	18:23	47.094	51.961	143
21	78	19:29	47.143	52.000	137
22	78	20: 1	47.207	52.058	144
23	78	20:46	47.264	52.103	141
24	78	21:27	47.324	52.154	140
25	78	22: 5	47.381	52.203	146
26	80	20:10	47.083	52.449	135
27	80	20:49	47.063	52.414	132
28	80	21:30	47.038	52.363	128
29	80	22: 5	47.002	52.327	120
30	80	22:37	47.000	52.293	124
31	80	23:35	46.978	52.250	128
32	81	0:18	46.959	52.218	133
33	81	1: 4	46.939	52.175	130
34	81	1:34	46.923	52.144	128
35	81	4:29	47.178	51.828	165
36	81	5:16	47.205	51.867	168
37	81	6: 1	47.221	51.906	165
38	81	6:44	47.241	51.940	155
39	81	7:32	47.248	51.954	144
40	81	8:15	47.281	52.021	150
41	81	9: 0	47.303	52.065	148
42	81	9:35	47.320	52.085	142
43	81	10: 8	47.348	52.134	140
44	81	17:11	47.294	52.325	152
45	81	19:21	47.300	52.184	142
46	81	20:24	47.302	52.089	142
47	81	21:16	47.297	51.940	158
48	81	22: 8	47.298	51.837	168
49	81	23: 1	47.300	51.724	157
50	81	23:56	47.293	51.583	142
51	82	0:54	47.296	51.457	115
52	82	1:56	47.295	51.341	126
53	82	3: 0	47.295	51.217	123
54	82	3:58	47.300	51.096	121
55	82	5:20	47.381	51.308	119
56	82	6:42	47.469	51.486	132
57	82	8: 2	47.546	51.722	168
58	82	9:17	47.631	51.940	175
59	82	10:52	47.721	52.157	175

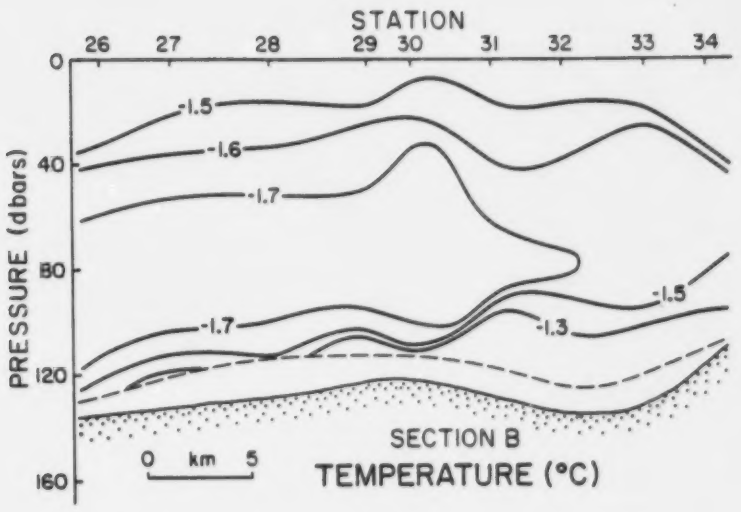
CRUISE 87002 CTD STATIONS

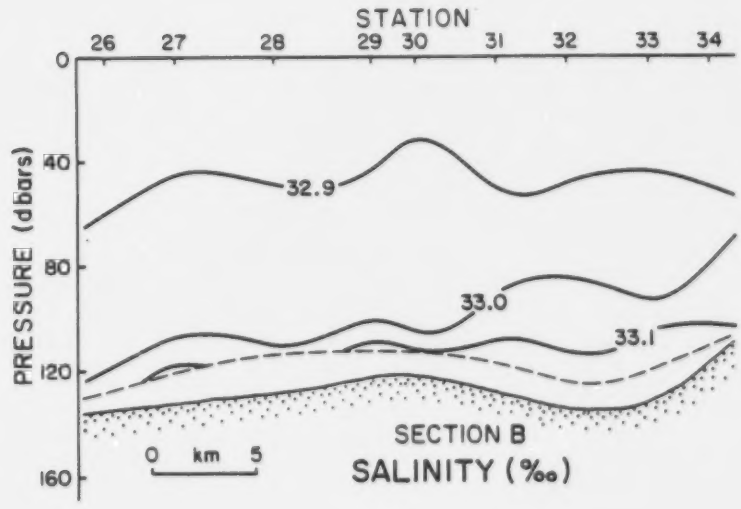
STN	DAY	TIME	LATITUDE	LONGITUDE	WATER DEPTH
60	82	12:36	47.809	52.423	173
61	82	19:47	47.624	52.371	166
62	82	21: 9	47.453	52.427	160
63	82	22:22	47.293	52.495	162
64	82	23:41	47.118	52.562	155
65	83	1:14	46.956	52.571	153
66	83	2:36	46.788	52.606	175
67	83	3:56	46.619	52.607	187
68	83	5:18	46.503	52.792	179
69	83	6:41	46.392	52.987	152
70	83	8: 0	46.325	53.192	129
71	83	9:26	46.218	53.267	148
72	83	10: 6	46.134	53.252	140
73	83	10:50	46.074	53.259	124
74	83	11:32	45.996	53.256	106
75	83	22:20	45.814	53.661	100
76	83	23: 4	45.878	53.666	108
77	83	23:51	45.944	53.682	
78	84	0:47	46.021	53.683	142
79	84	1:46	46.091	53.658	146
80	84	2:30	46.171	53.684	152
81	84	3:36	46.229	53.699	139
82	84	14:22	46.450	52.975	110
83	85	18:26	46.925	52.782	154
84	85	18:52	46.927	52.765	157
85	86	0:29	47.195	52.703	157
86	86	1:20	47.139	52.619	151
87	86	2:13	47.085	52.568	150
88	86	3:15	47.032	52.439	128
89	86	4:10	46.976	52.350	117
90	86	5: 4	46.924	52.263	124

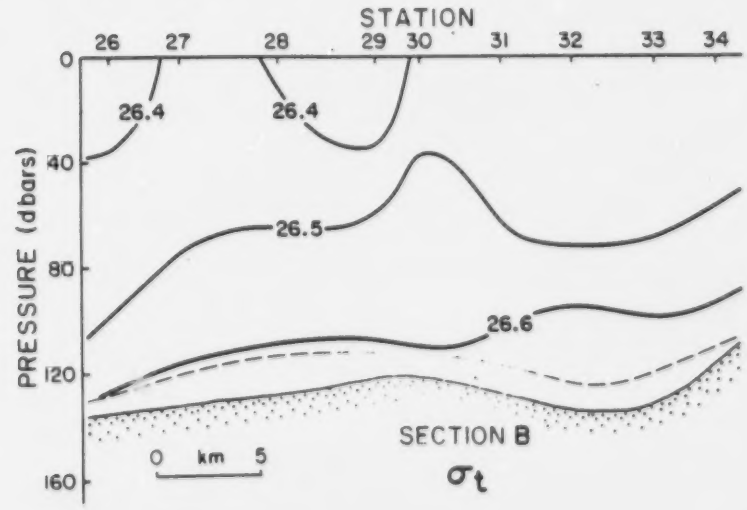

STATION
8
7
6
5
4
3
2
0
50
100
150
PRESSURE (dbars)
-1.2
-1.1
-1.0
-1.2
-1.1
-0.7
0
km
10
SECTION A
TEMPERATURE (°C)

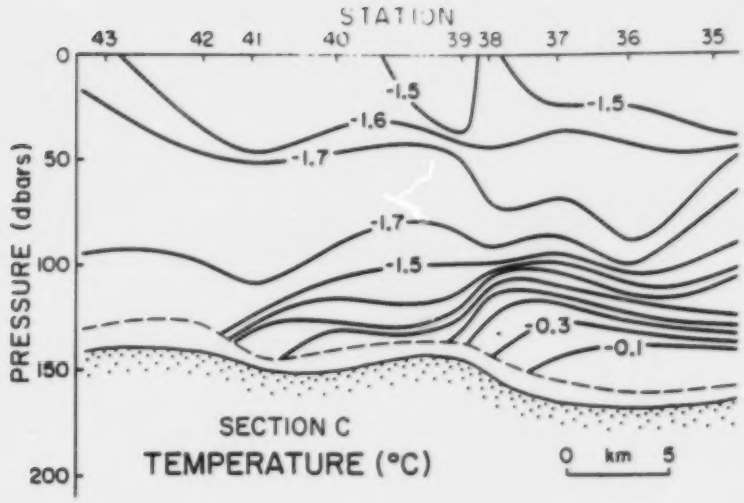

STATION
8
7
6
5
4
3
2
0
50
100
150
PRESSURE (dbars)
32.8
32.9
33.0
33.2
0
km
10
SECTION A
SALINITY (‰)

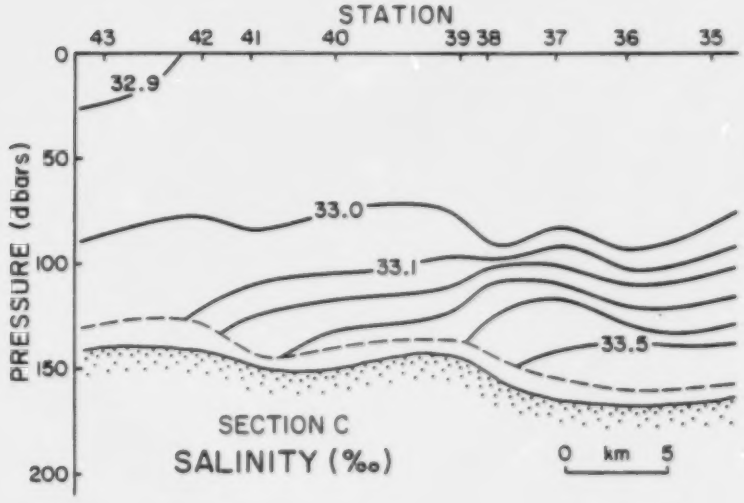

STATION
8
7
6
5
4
3
2
0
50
100
150
PRESSURE (dbars)
26.2
26.3
26.4
26.5
26.7
0
km
10
SECTION A
σ_t

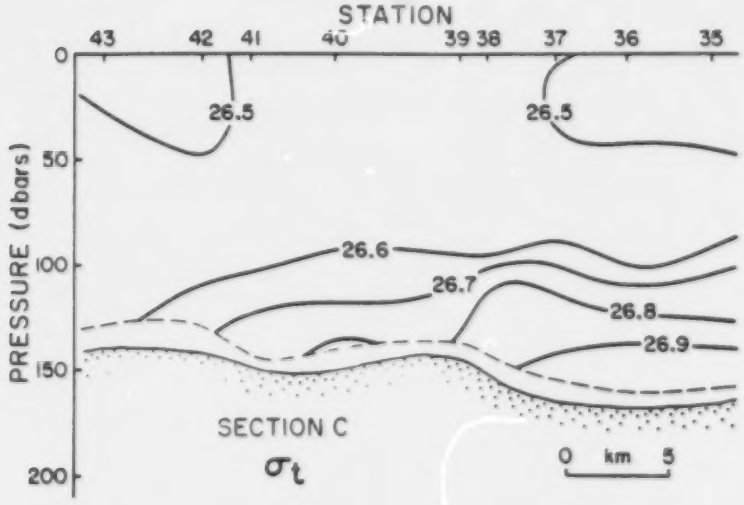

STATION
26 27 28 29 30 31 32 33 34
0
40
80
120
160
PRESSURE (dbars)
-1.5
-1.6
-1.7
-1.7
-1.5
-1.3
0 km 5
SECTION B
TEMPERATURE (°C)

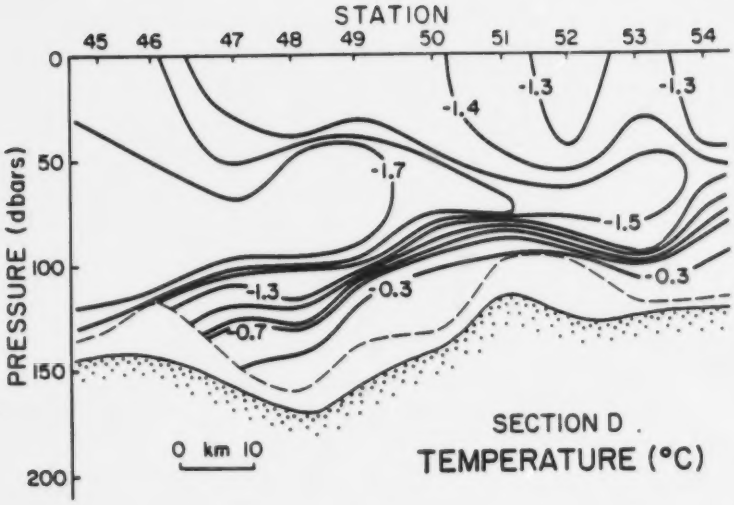

STATION
26 27 28 29 30 31 32 33 34
0
40
80
120
160
PRESSURE (dbars)
32.9
33.0
33.1
0 km 5
SECTION B
SALINITY (‰)

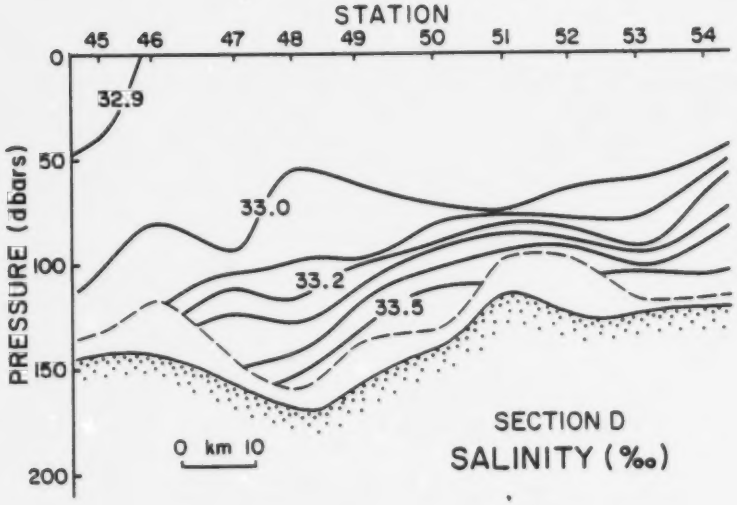

STATION
26 27 28 29 30 31 32 33 34
0
40
80
120
160
PRESSURE (dbars)
26.4
26.4
26.5
26.6
0 km 5
SECTION B
σ_t

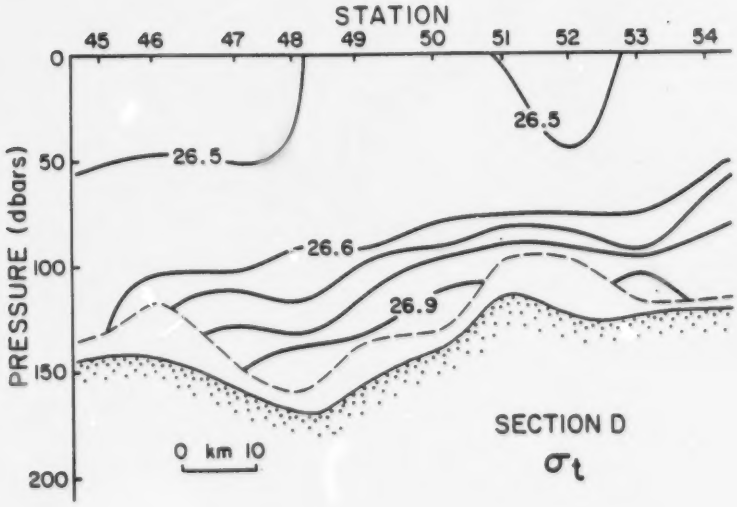

STATION
43 42 41 40 39 38 37 36 35
PRESSURE (dbars)
0 50 100 150 200
-1.5
-1.6
-1.7
-1.7
-1.5
-0.3
-0.1
SECTION C
TEMPERATURE (°C)
0 km 5

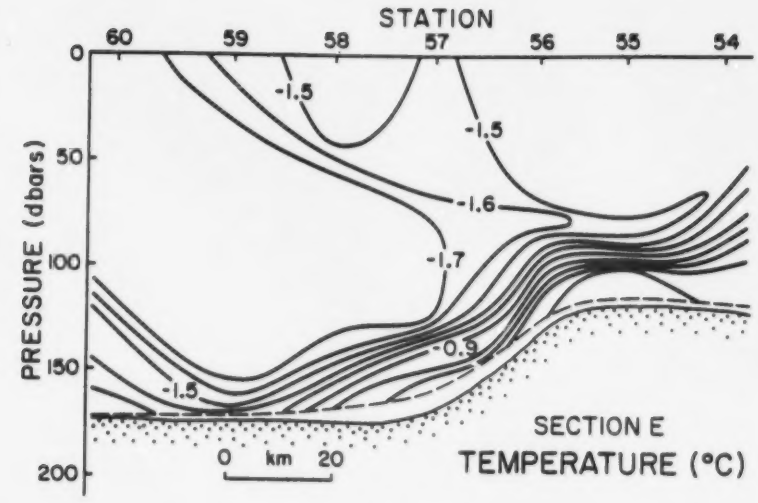

STATION
43 42 41 40 39 38 37 36 35
PRESSURE (dbars)
0 50 100 150 200
32.9
33.0
33.1
33.5
SECTION C
SALINITY (‰)
0 km 5

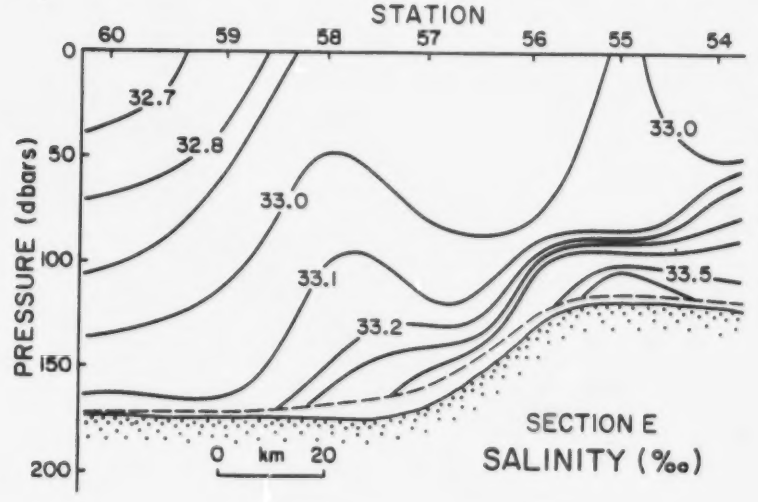

STATION
43 42 41 40 39 38 37 36 35
PRESSURE (dbars)
0 50 100 150 200
26.5
26.5
26.6
26.7
26.8
26.9
SECTION C
σ_t
0 km 5

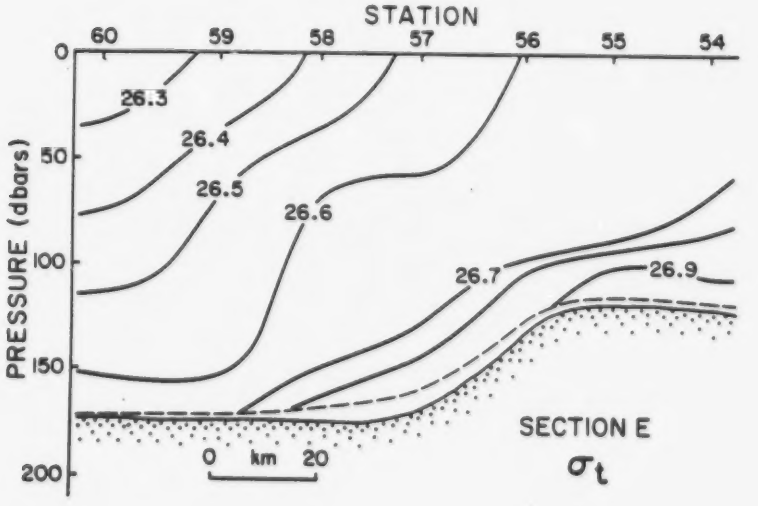

STATION
45 46 47 48 49 50 51 52 53 54
PRESSURE (dbars)
0
50
100
150
200
-1.4
-1.3
-1.3
-1.7
-1.5
-0.3
-1.3
-0.3
-0.7
0 km 10
SECTION D
TEMPERATURE (°C)

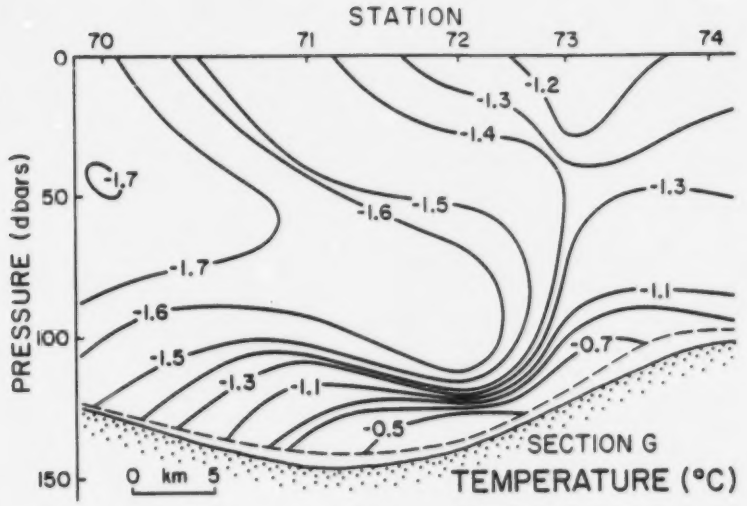

STATION
45 46 47 48 49 50 51 52 53 54
PRESSURE (dbars)
0
50
100
150
200
32.9
33.0
33.2
33.5
0 km 10
SECTION D
SALINITY (‰)

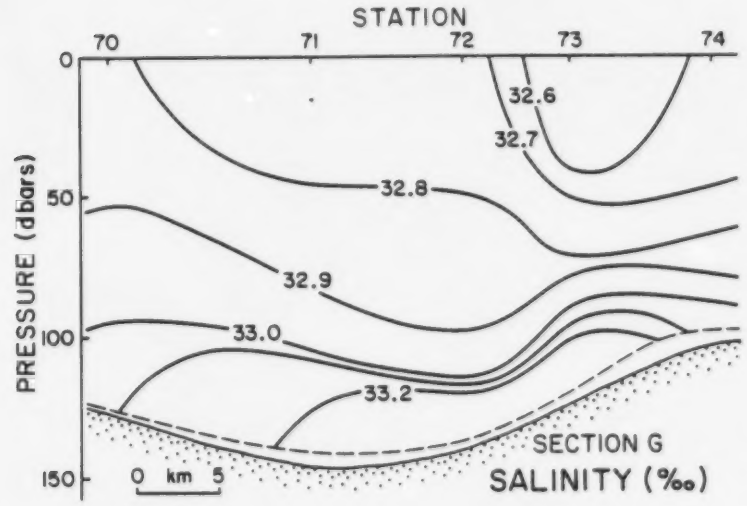

STATION
45 46 47 48 49 50 51 52 53 54
PRESSURE (dbars)
0
50
100
150
200
26.5
26.5
26.6
26.9
0 km 10
SECTION D
σ_t

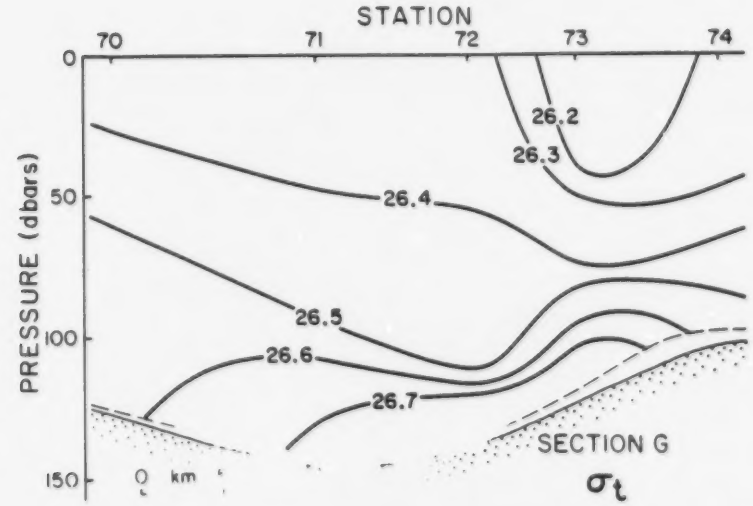

STATION
60
59
58
57
56
55
54
0
50
100
150
200
PRESSURE (dbars)
-1.5
-1.5
-1.6
-1.7
-0.9
-1.5
0 km 20
SECTION E
TEMPERATURE (°C)

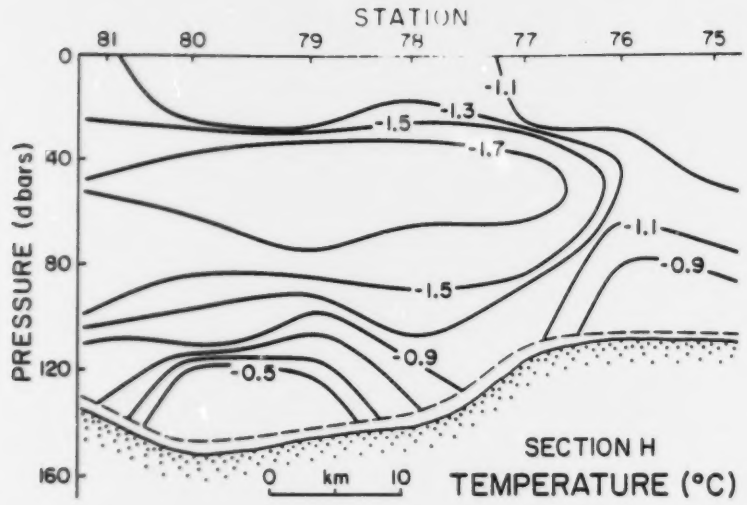

STATION
60
59
58
57
56
55
54
0
50
100
150
200
PRESSURE (dbars)
32.7
32.8
33.0
33.0
33.1
33.2
33.5
0 km 20
SECTION E
SALINITY (‰)

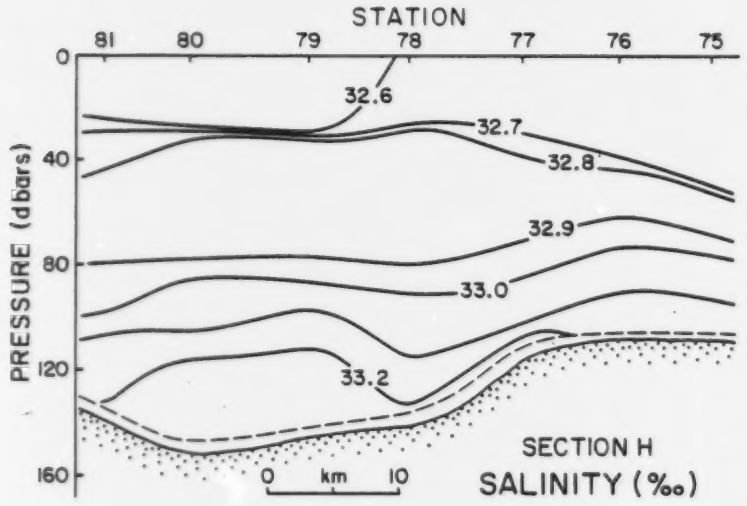

STATION
60
59
58
57
56
55
54
0
50
100
150
200
PRESSURE (dbars)
26.3
26.4
26.5
26.6
26.7
26.9
0 km 20
SECTION E
σ_t

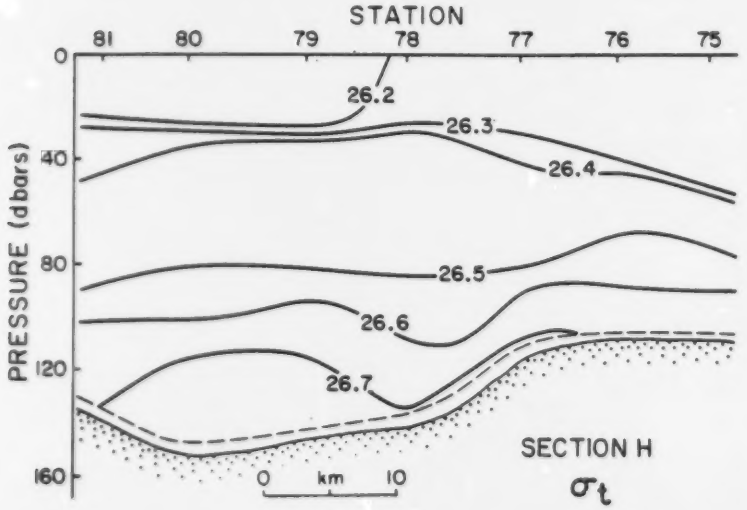

STATION
70
71
72
73
74
0
50
100
150
PRESSURE (dbars)
-1.7
-1.6
-1.5
-1.4
-1.3
-1.2
-1.1
-0.7
-0.5
SECTION G
0 km 5
TEMPERATURE (°C)

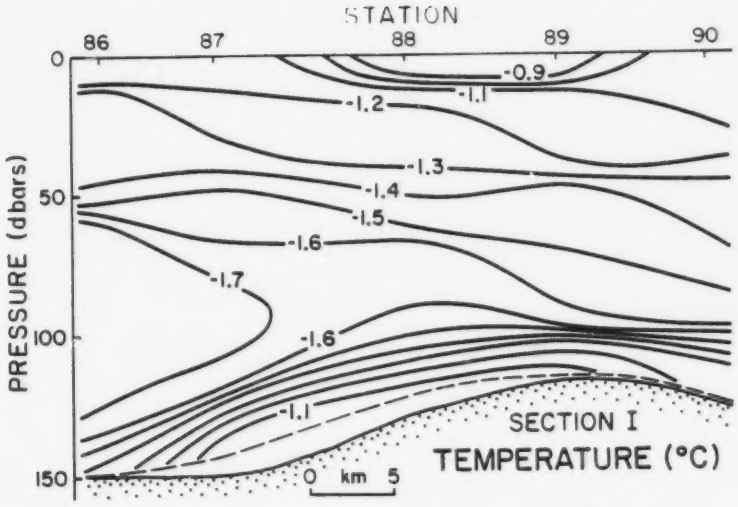

STATION
70
71
72
73
74
0
50
100
150
PRESSURE (dbars)
32.6
32.7
32.8
32.9
33.0
33.2
SECTION G
0 km 5
SALINITY (‰)

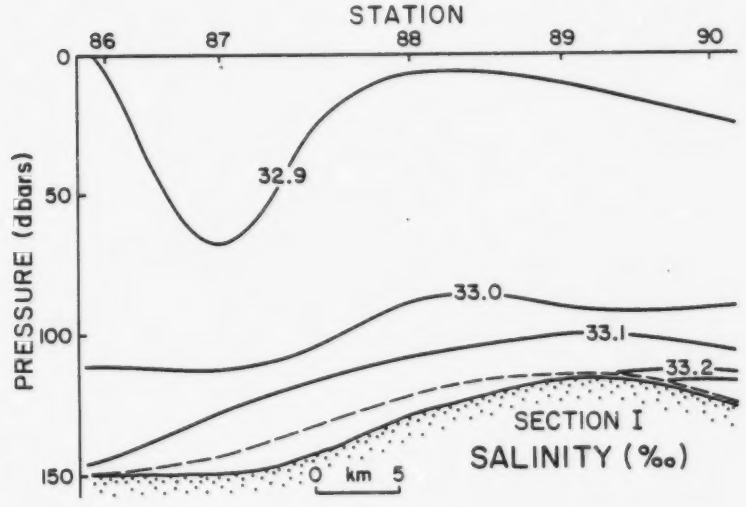

STATION
70
71
72
73
74
0
50
100
150
PRESSURE (dbars)
26.2
26.3
26.4
26.5
26.6
26.7
SECTION G
0 km
σ_t

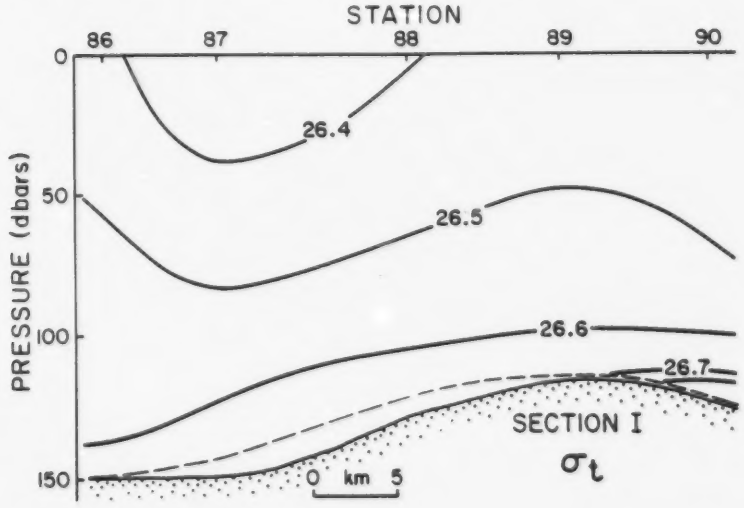

STATION
81 80 79 78 77 76 75
PRESSURE (dbars)
0
40
80
120
160
-1.1
-1.3
-1.5
-1.7
-1.1
-0.9
-1.5
-0.9
-0.5
0 km 10
SECTION H
TEMPERATURE (°C)

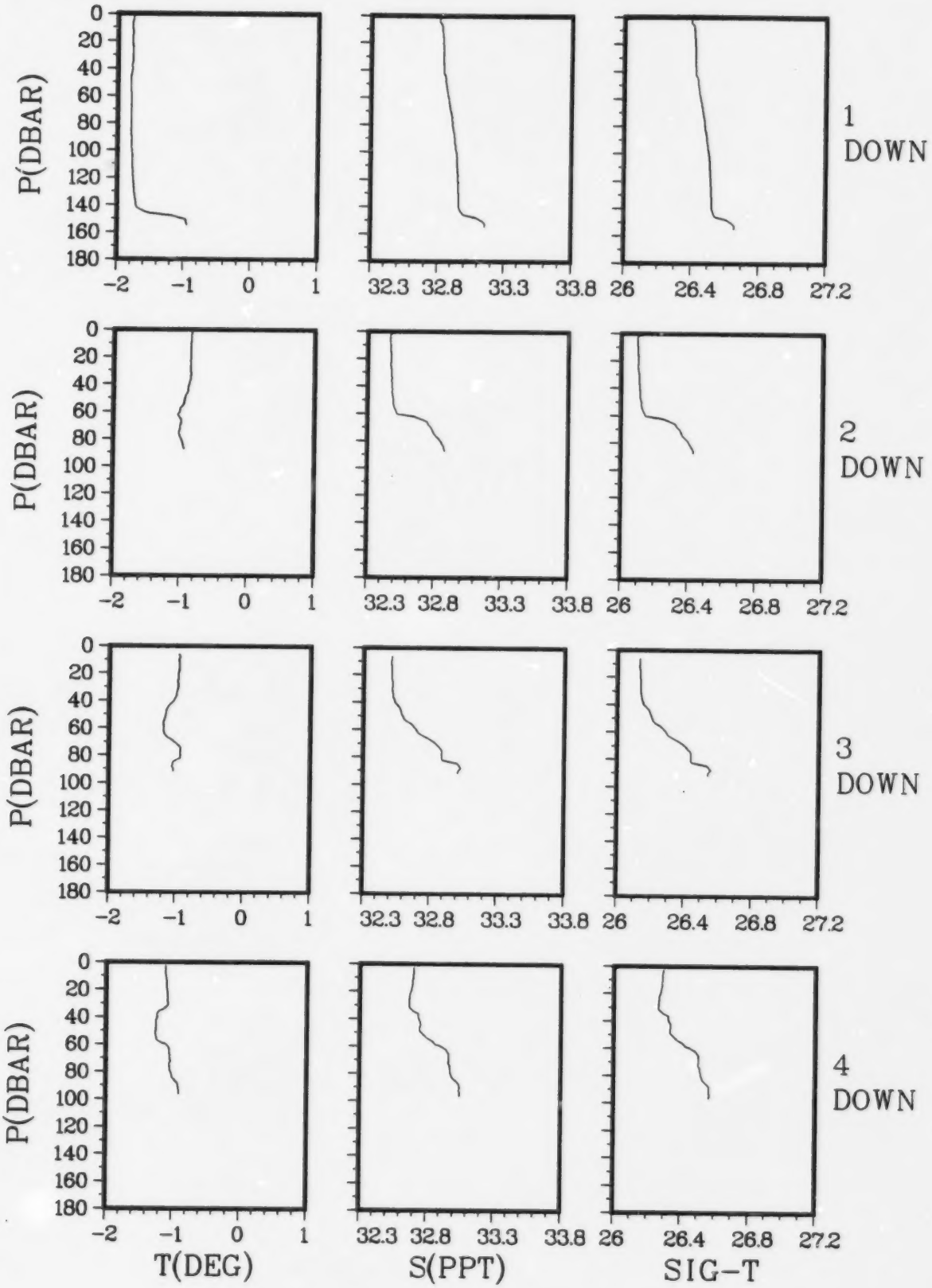

STATION
81 80 79 78 77 76 75
PRESSURE (dbars)
0
40
80
120
160
32.6
32.7
32.8
32.9
33.0
33.2
0 km 10
SECTION H
SALINITY (‰)

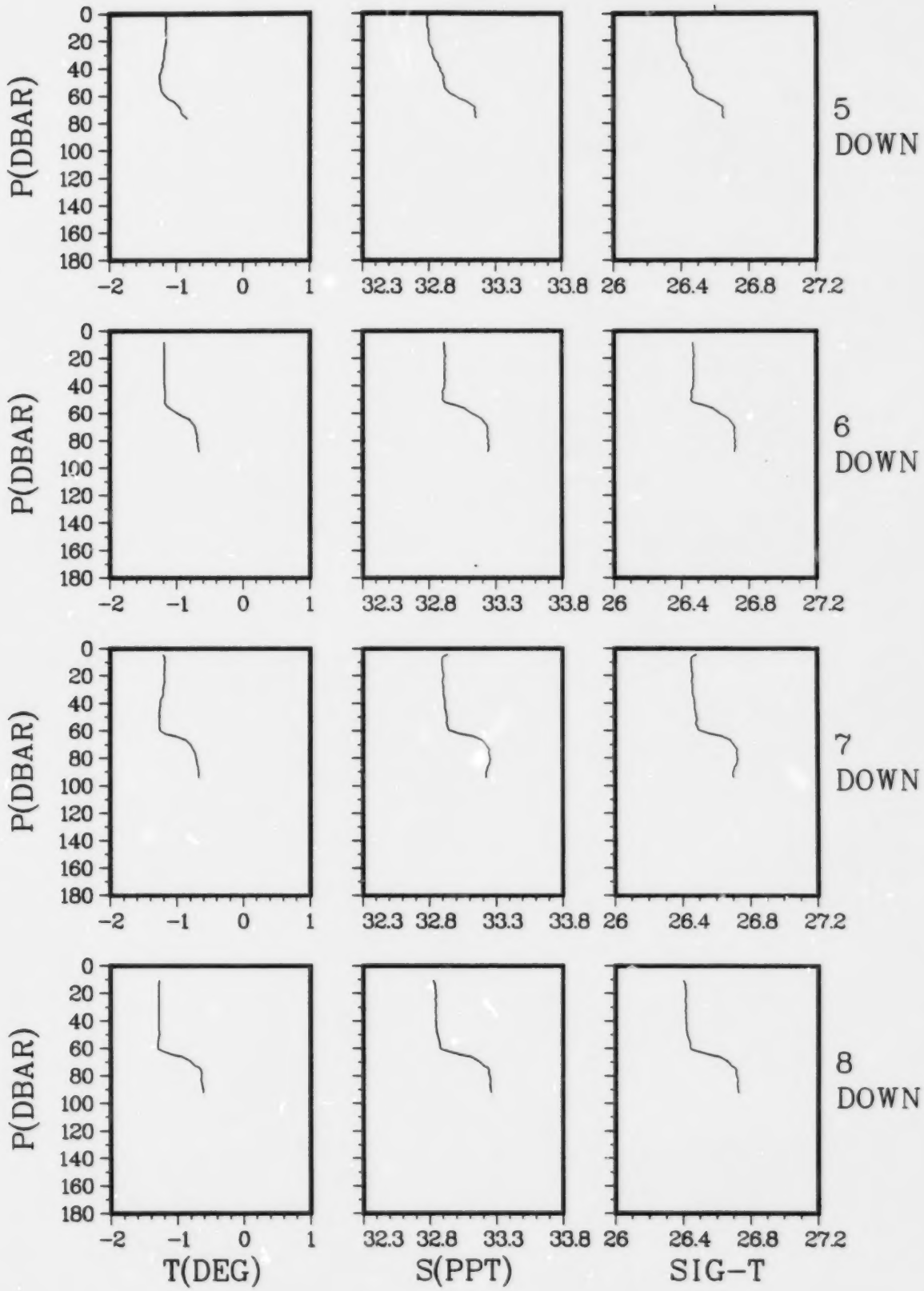

STATION
81 80 79 78 77 76 75
PRESSURE (dbars)
0
40
80
120
160
26.2
26.3
26.4
26.5
26.6
26.7
0 km 10
SECTION H
σ_t

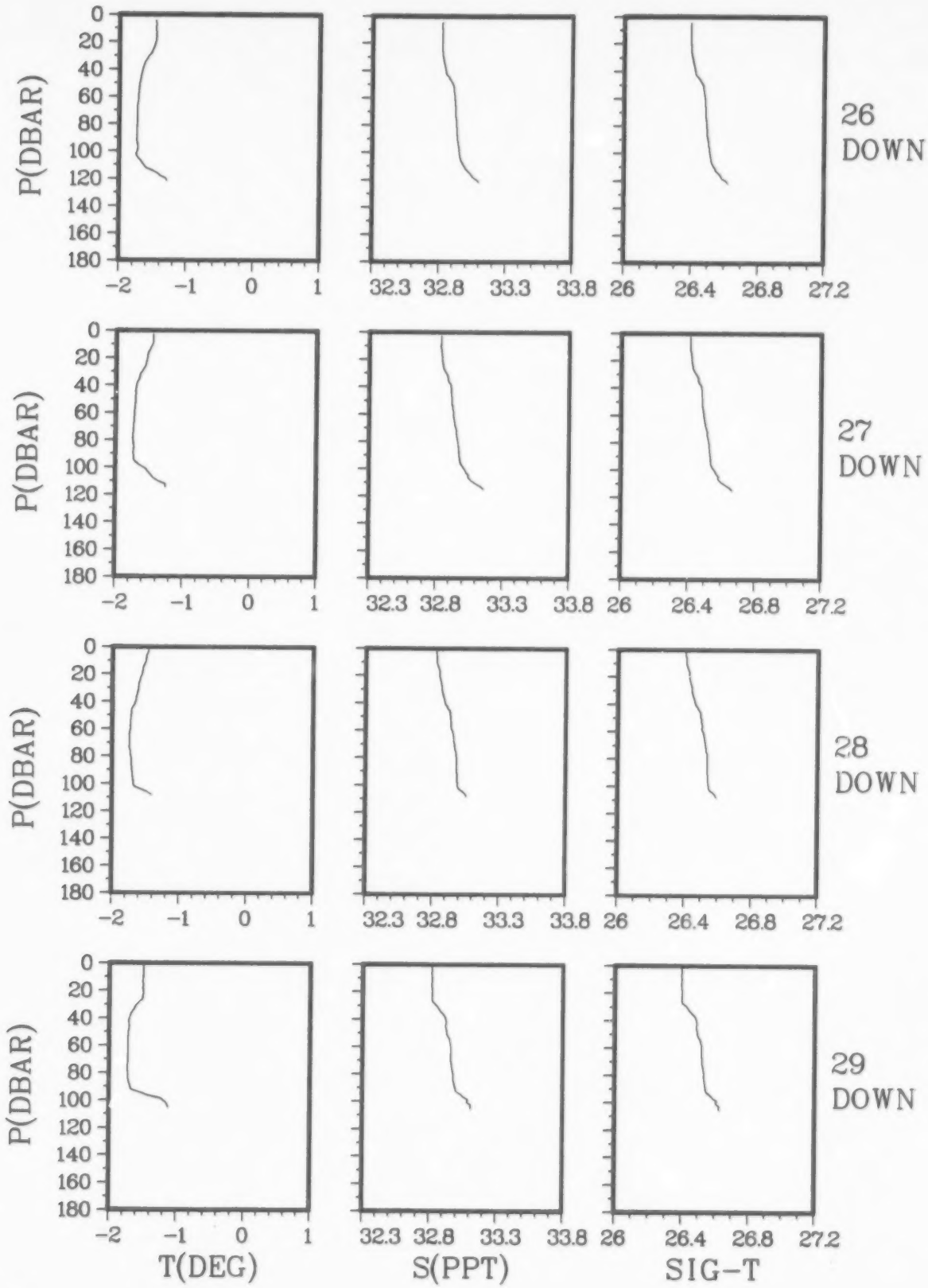

STATION
86
87
88
89
90
0
50
100
150
PRESSURE (dbars)
-0.9
-1.1
-1.2
-1.3
-1.4
-1.5
-1.6
-1.7
-1.6
-1.1
SECTION I
TEMPERATURE (°C)
0 km 5

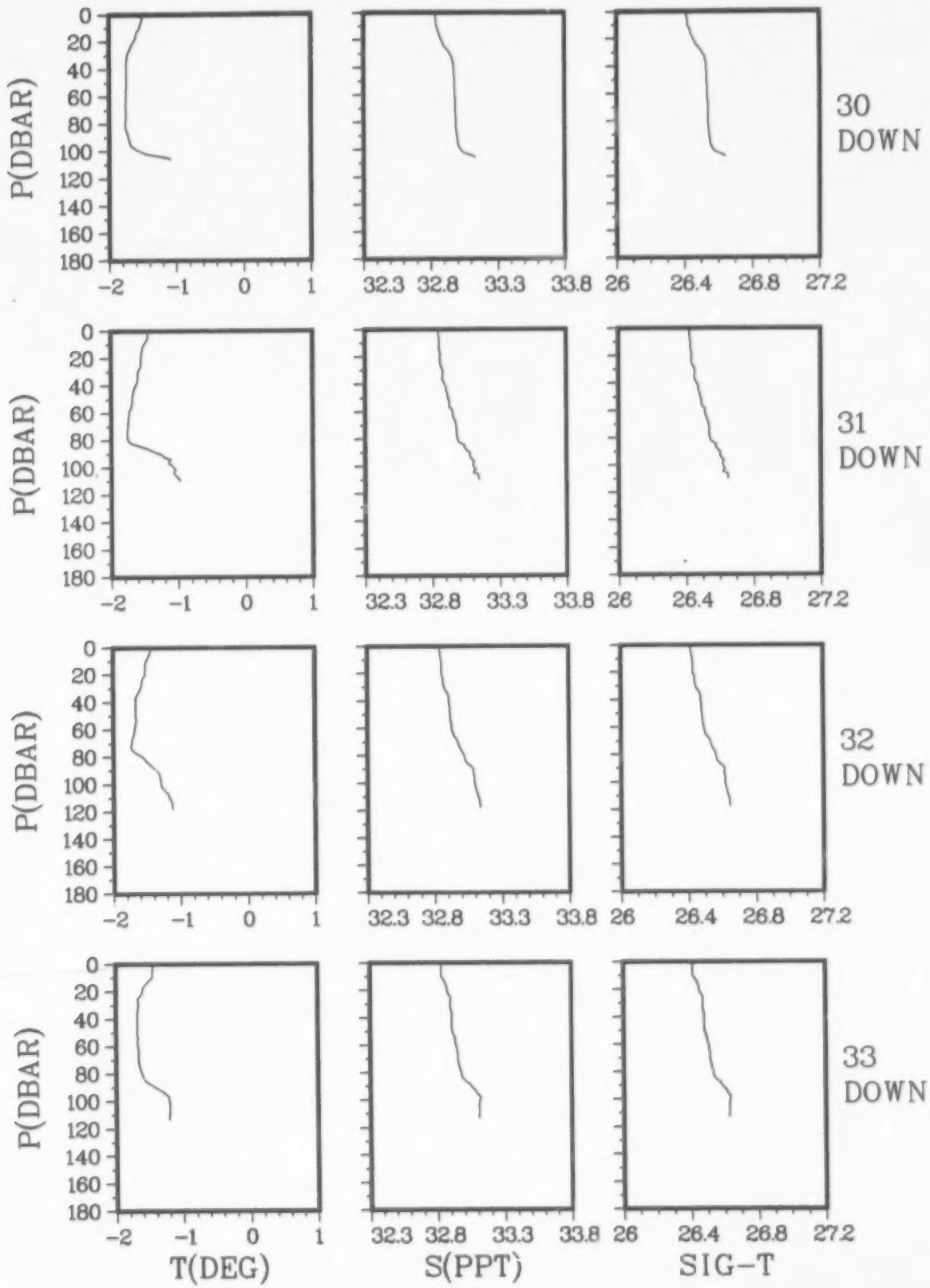

STATION
86
87
88
89
90
0
50
100
150
PRESSURE (dbars)
32.9
33.0
33.1
33.2
SECTION I
SALINITY (‰)
0 km 5

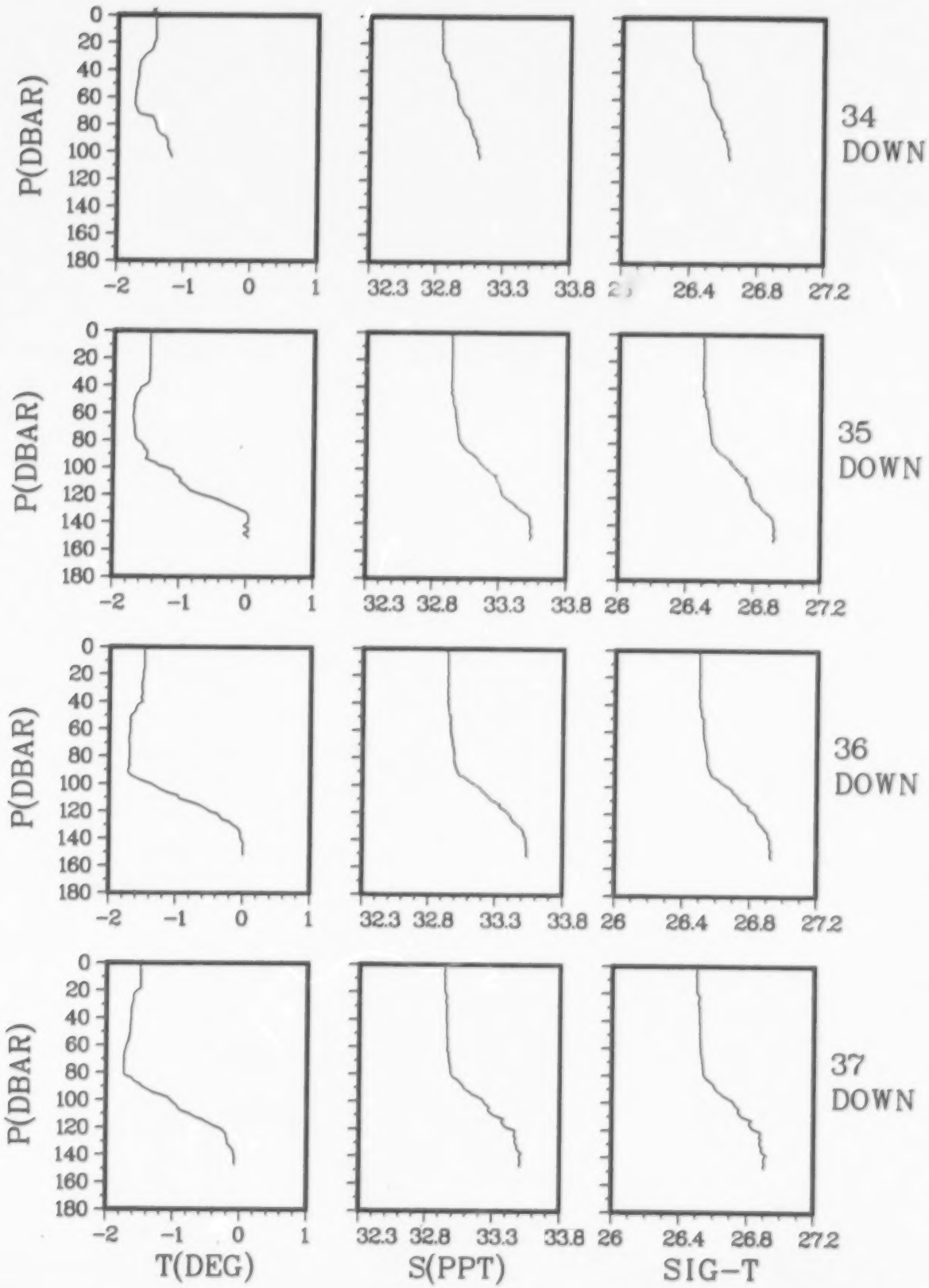

STATION
86
87
88
89
90
0
50
100
150
PRESSURE (dbars)
26.4
26.5
26.6
26.7
SECTION I
σt
0 km 5

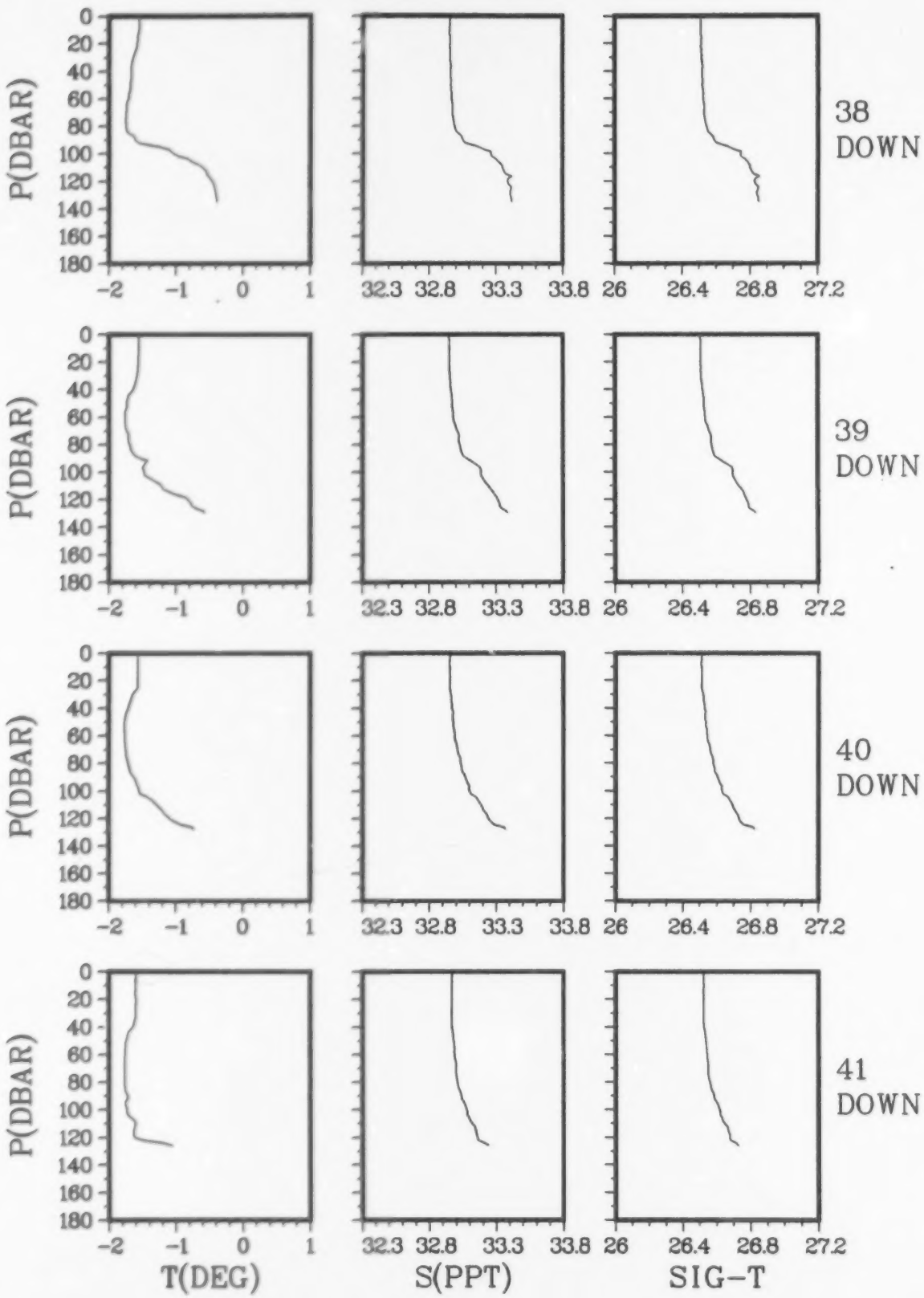

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
1
DOWN
2
DOWN
3
DOWN
4
DOWN
T(DEG)
S(PPT)
SIG−T

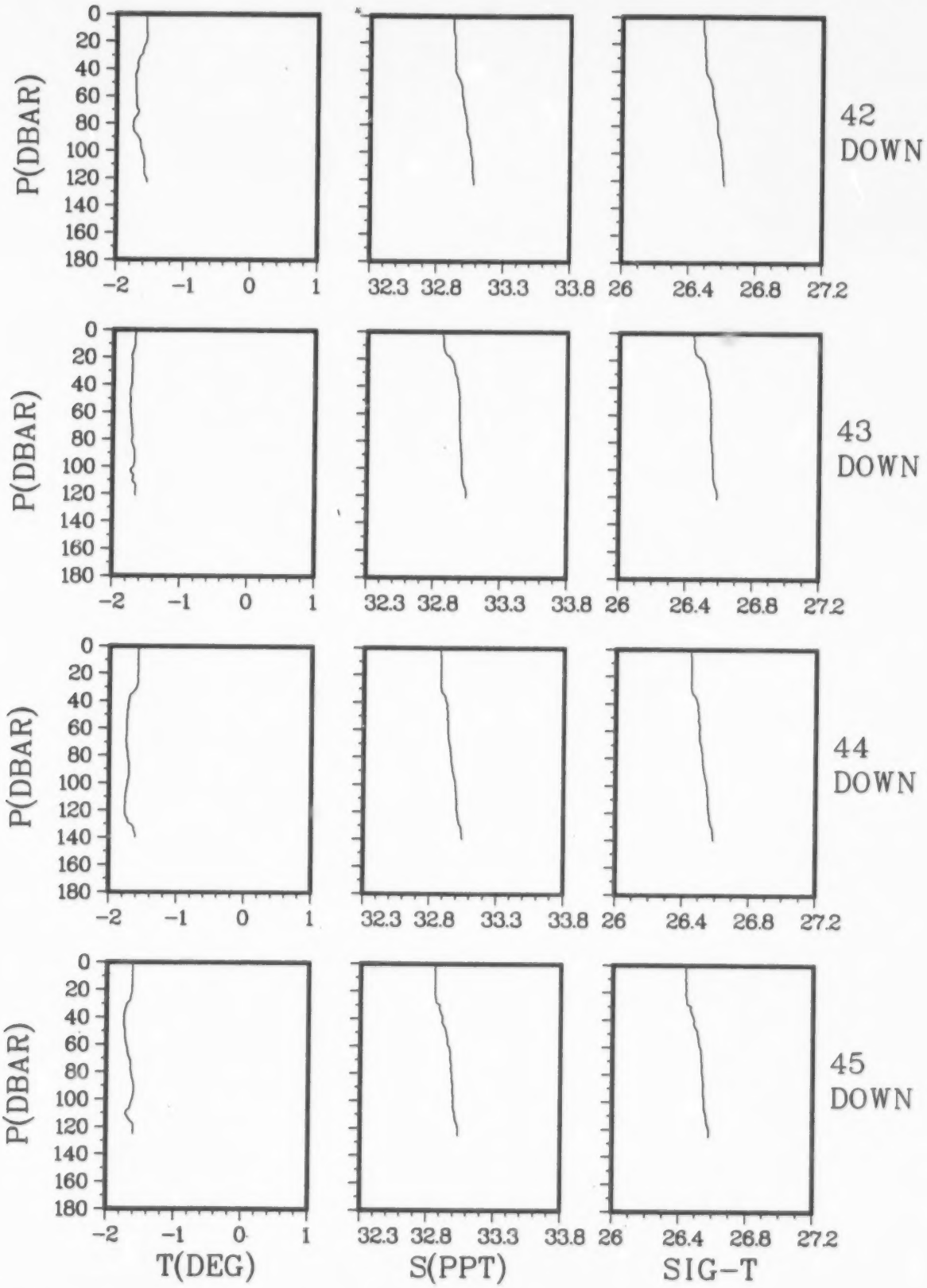

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
5
DOWN
6
DOWN
7
DOWN
8
DOWN
T(DEG)
S(PPT)
SIG-T

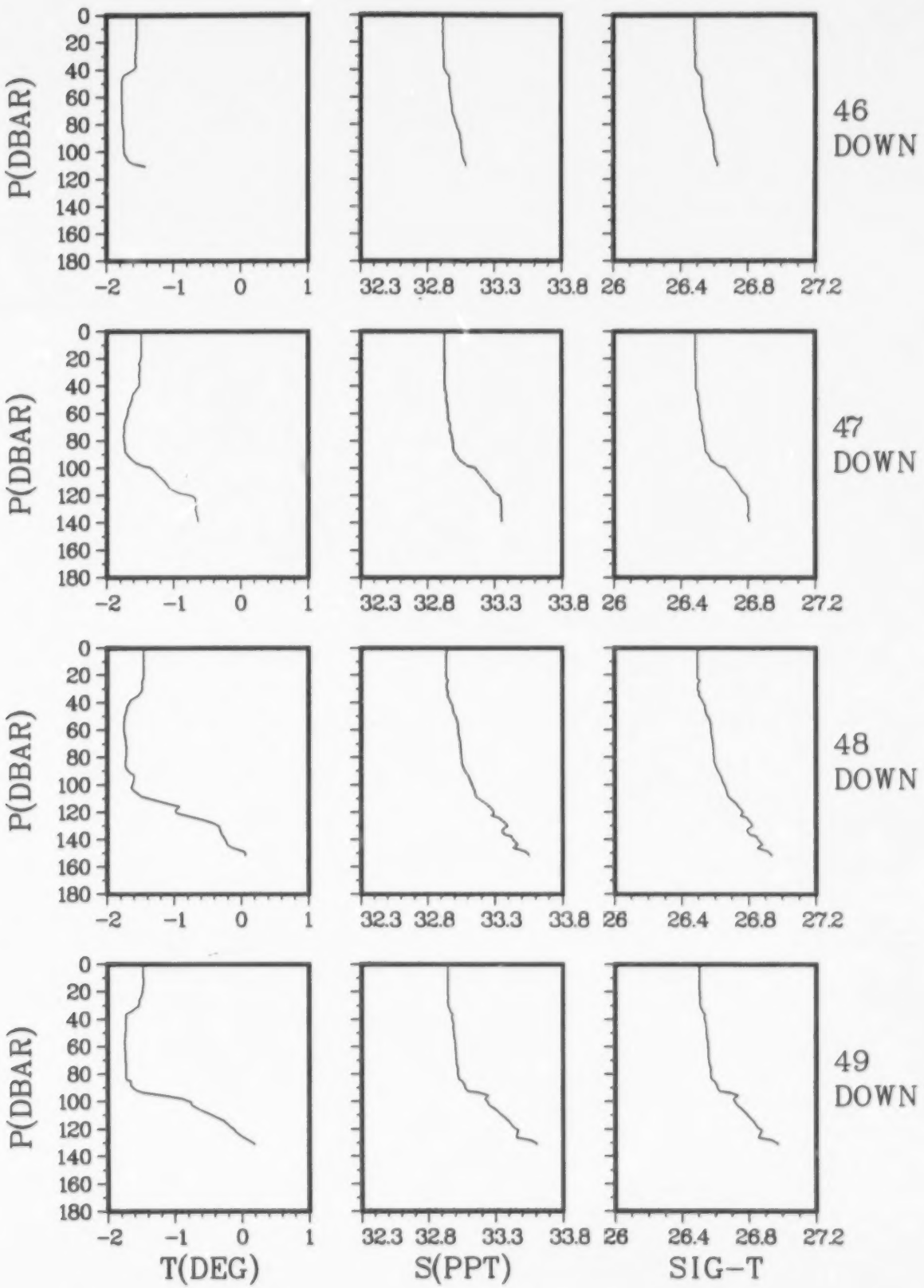

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
26 DOWN
27 DOWN
28 DOWN
29 DOWN
T(DEG)
S(PPT)
SIG−T

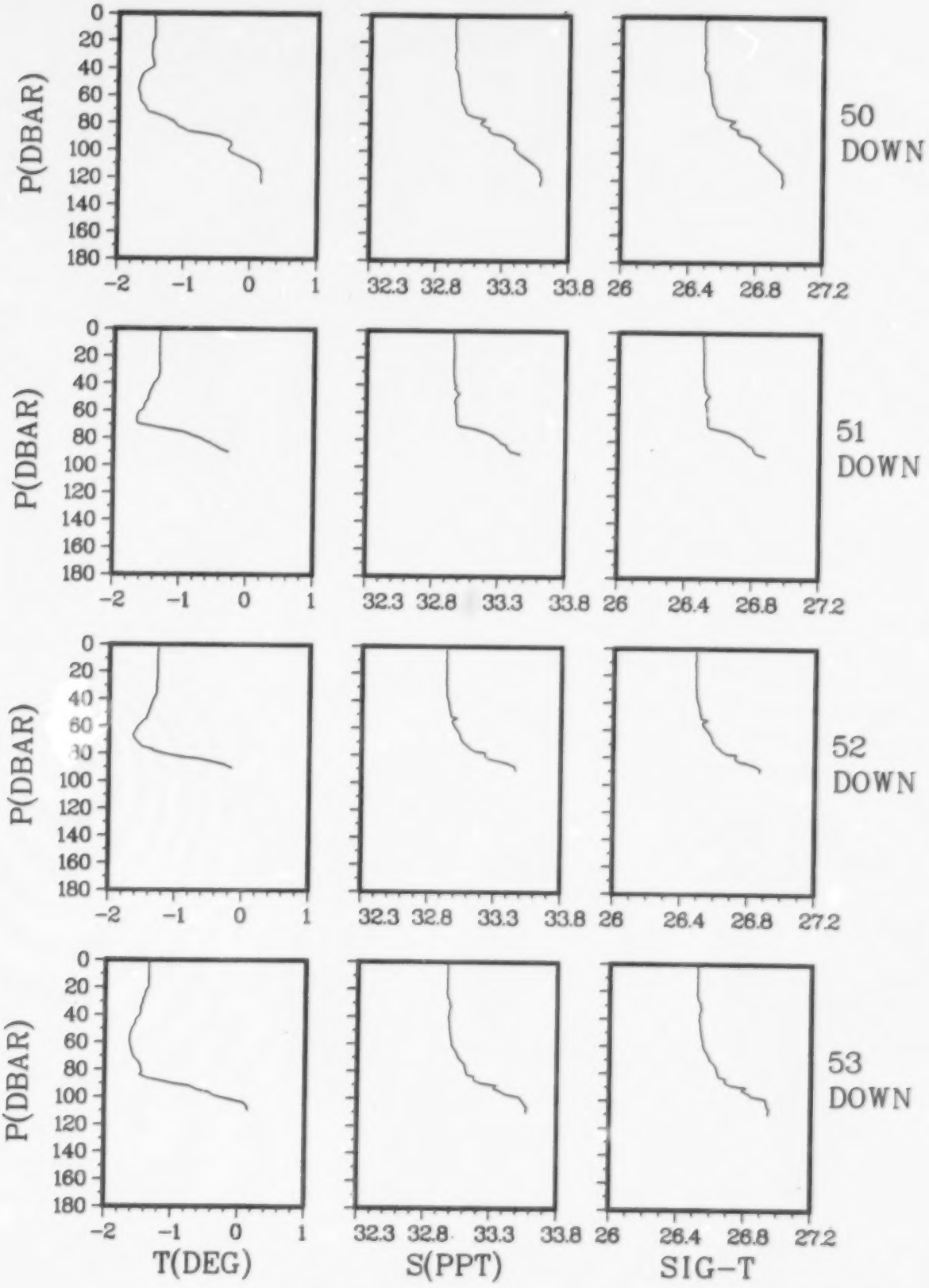

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
30
DOWN
31
DOWN
32
DOWN
33
DOWN
T(DEG)
S(PPT)
SIG-T

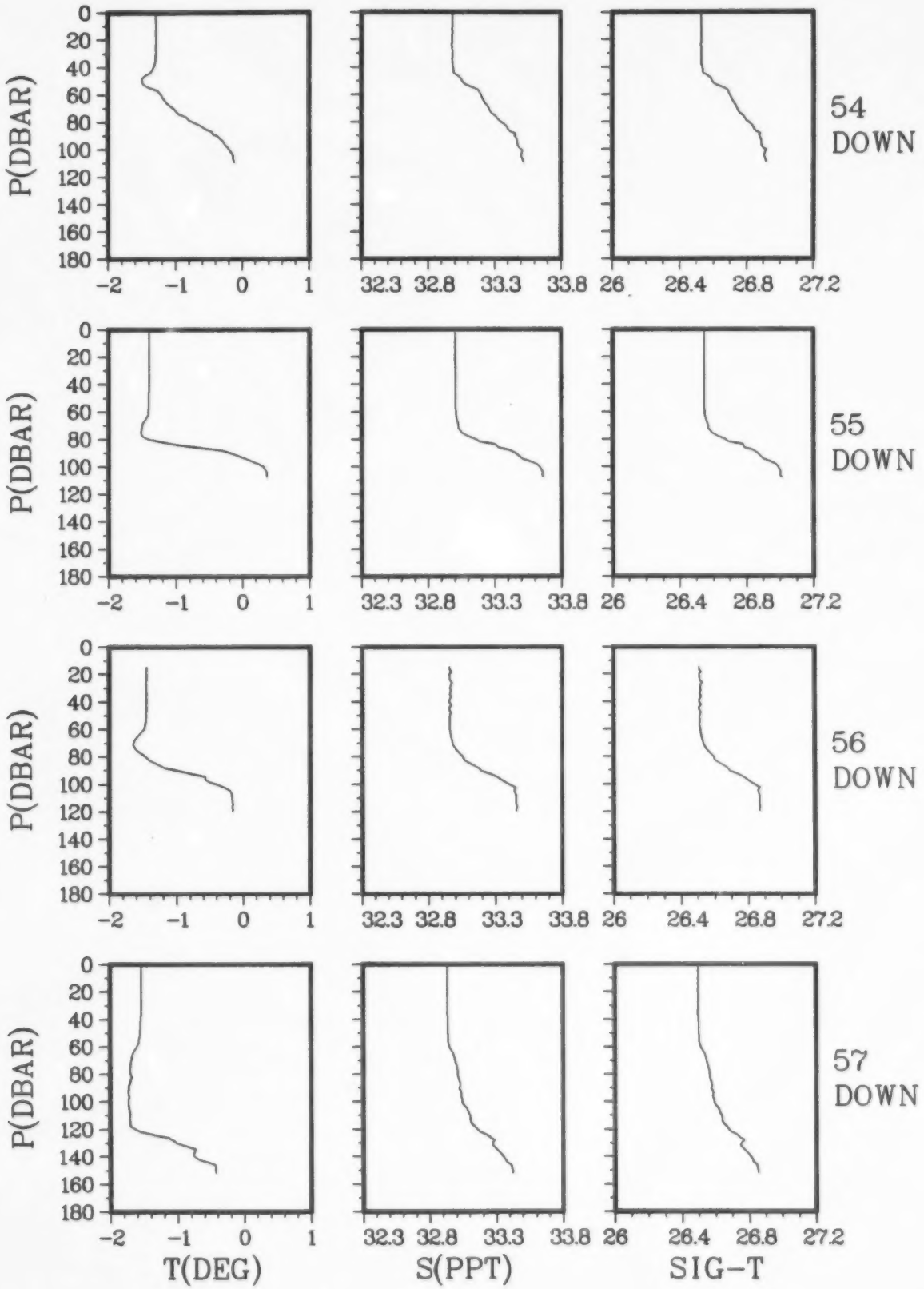

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
34
DOWN
35
DOWN
36
DOWN
37
DOWN
T(DEG)
S(PPT)
SIG-T

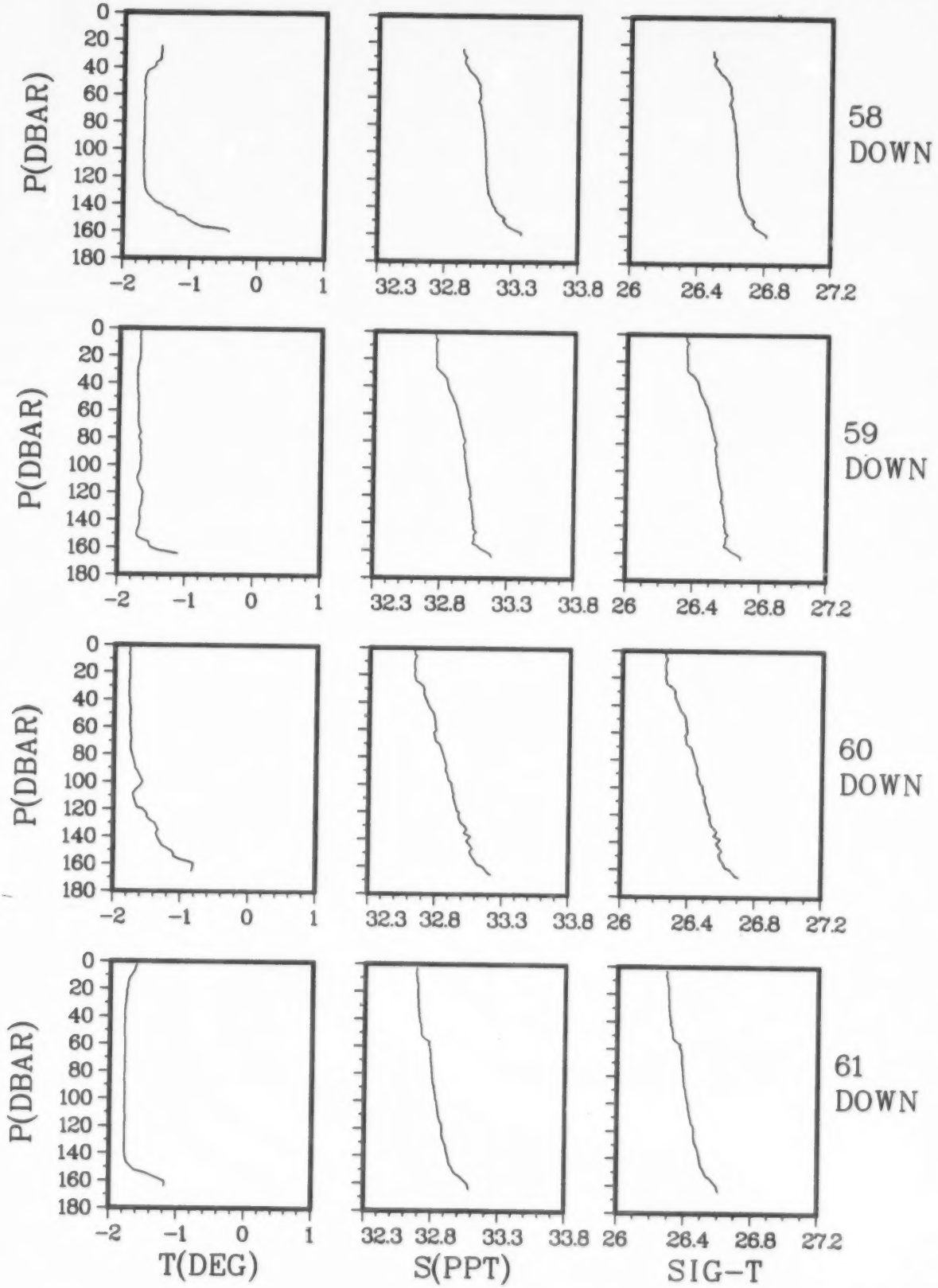

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
38
DOWN
39
DOWN
40
DOWN
41
DOWN
T(DEG)
S(PPT)
SIG-T

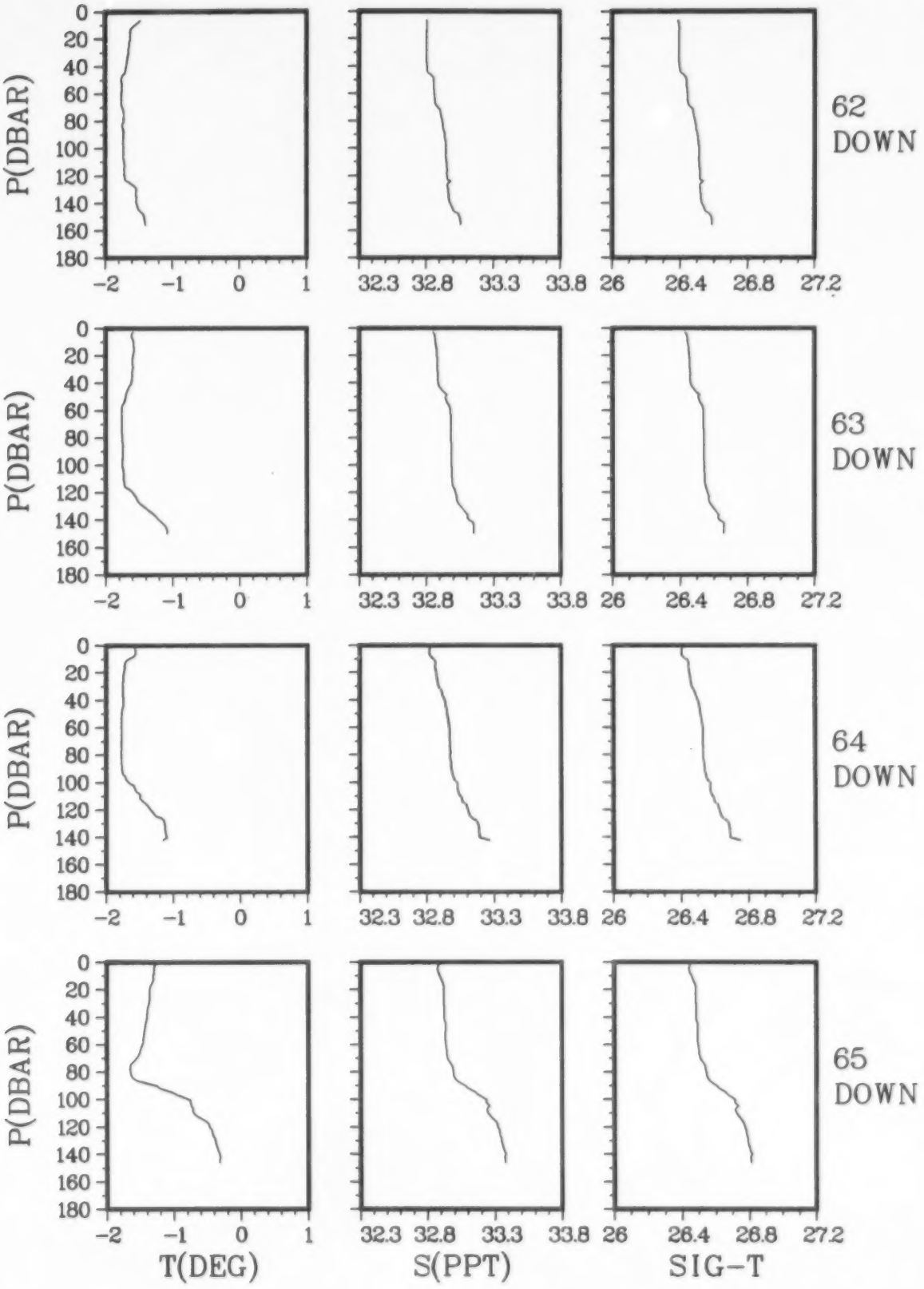

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
42
DOWN
43
DOWN
44
DOWN
45
DOWN
T(DEG)
S(PPT)
SIG−T

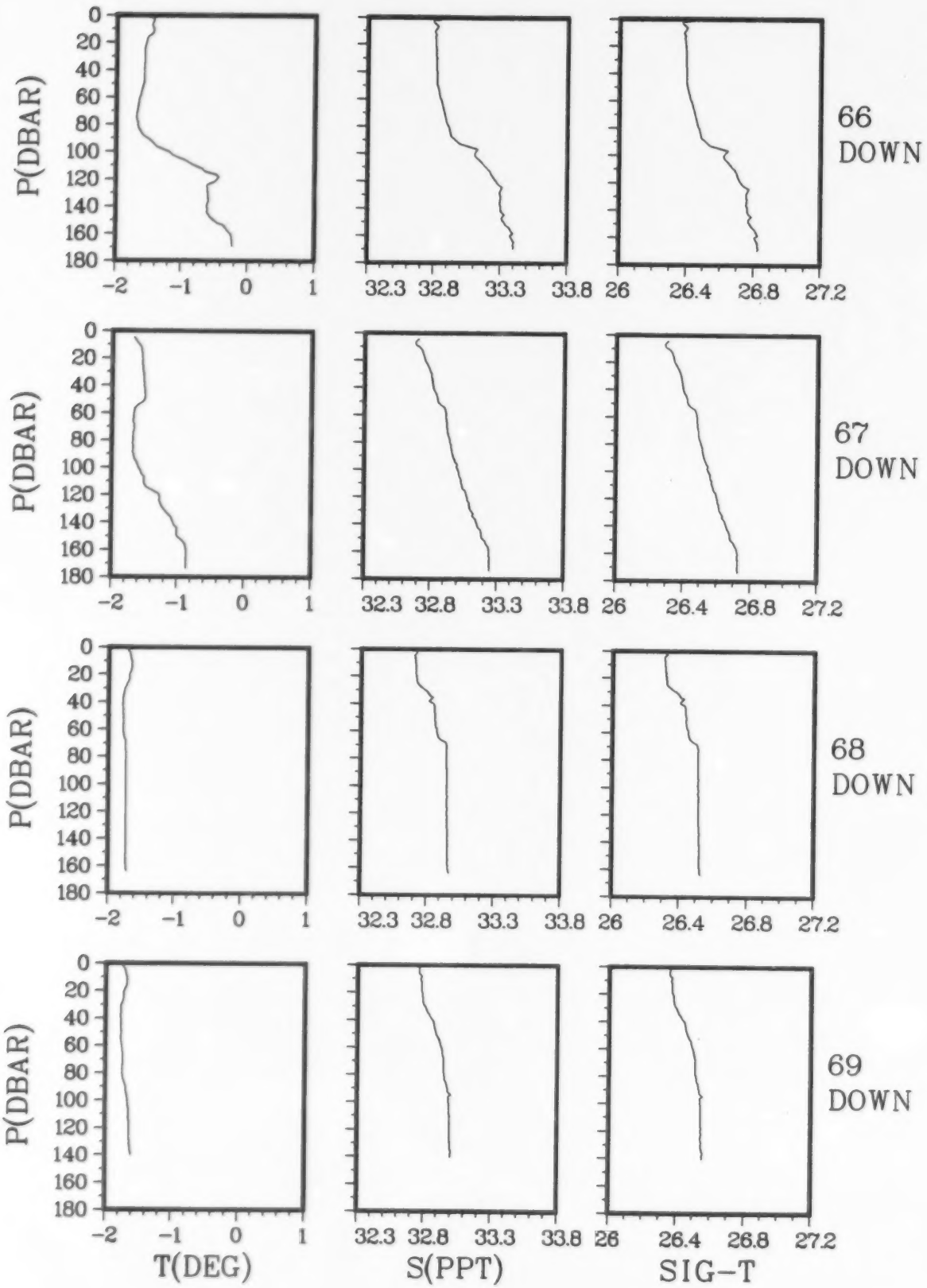

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
46
DOWN
47
DOWN
48
DOWN
49
DOWN
T(DEG)
S(PPT)
SIG-T

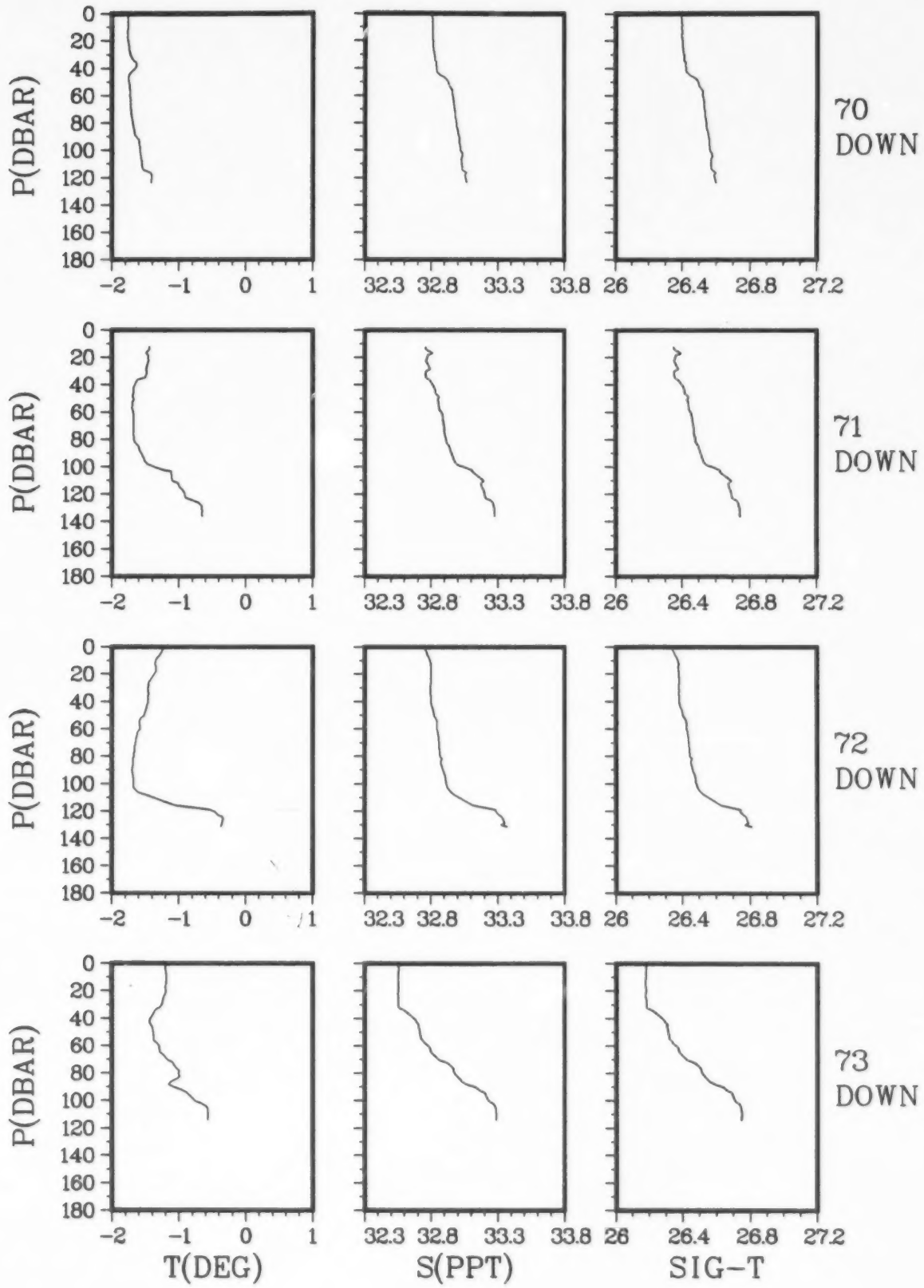

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
50
DOWN
51
DOWN
52
DOWN
53
DOWN
T(DEG)
S(PPT)
SIG-T

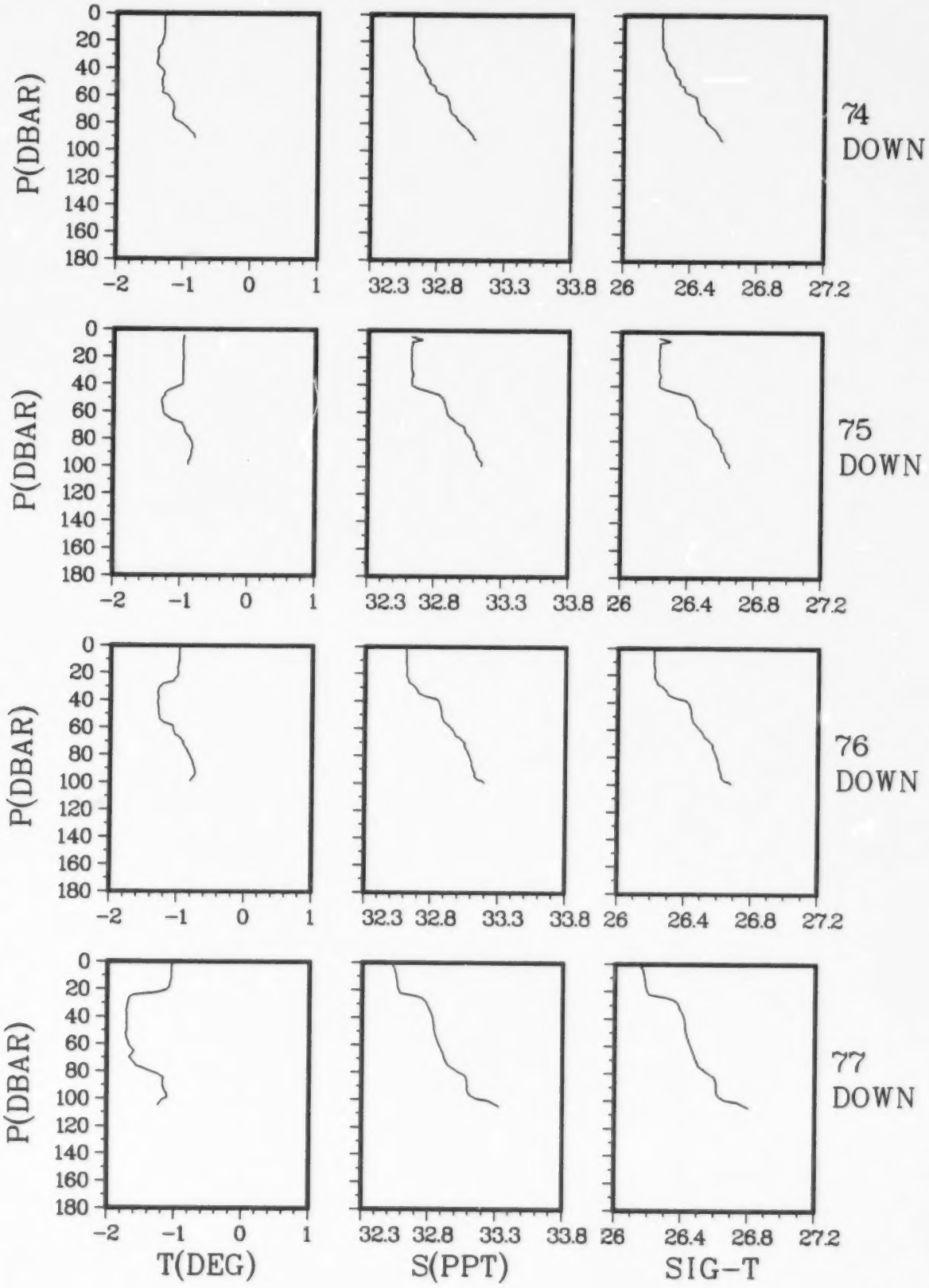

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
54
DOWN
55
DOWN
56
DOWN
57
DOWN
T(DEG)
S(PPT)
SIG-T

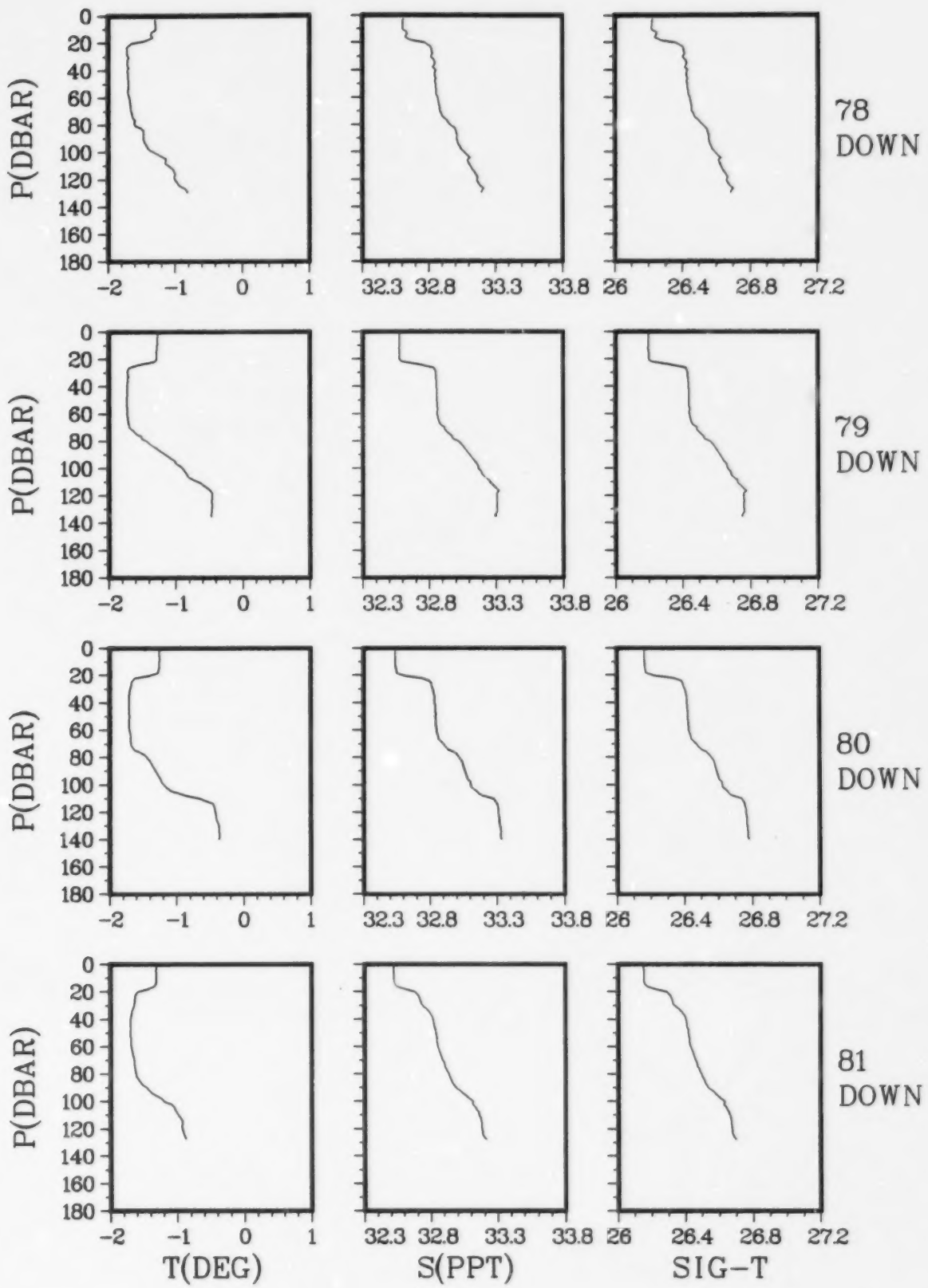

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2 −1 0 1
32.3 32.8 33.3 33.8
26 26.4 26.8 27.2
58
DOWN
59
DOWN
60
DOWN
61
DOWN
T(DEG)
S(PPT)
SIG−T

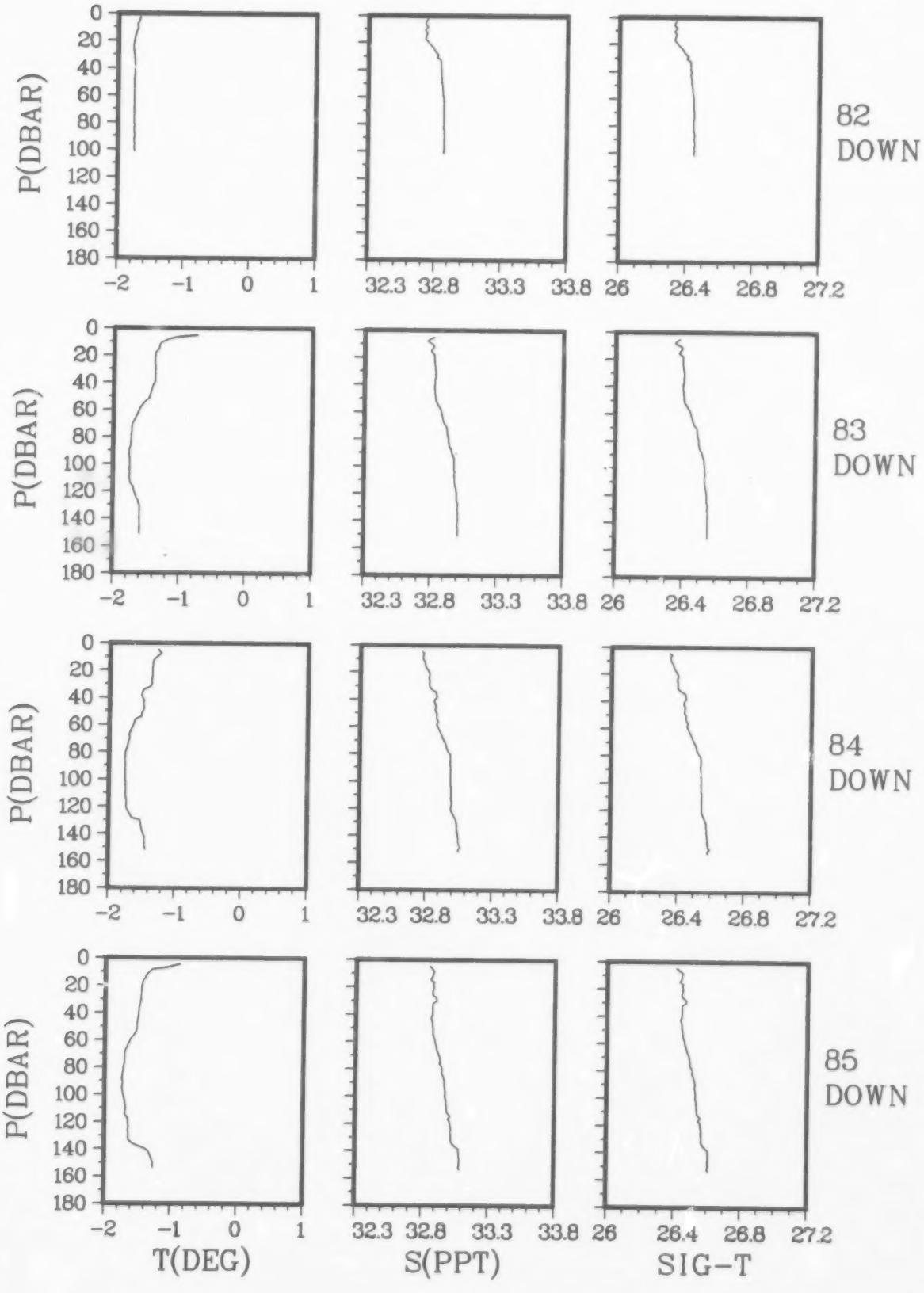

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
62
DOWN
63
DOWN
64
DOWN
65
DOWN
T(DEG)
S(PPT)
SIG−T

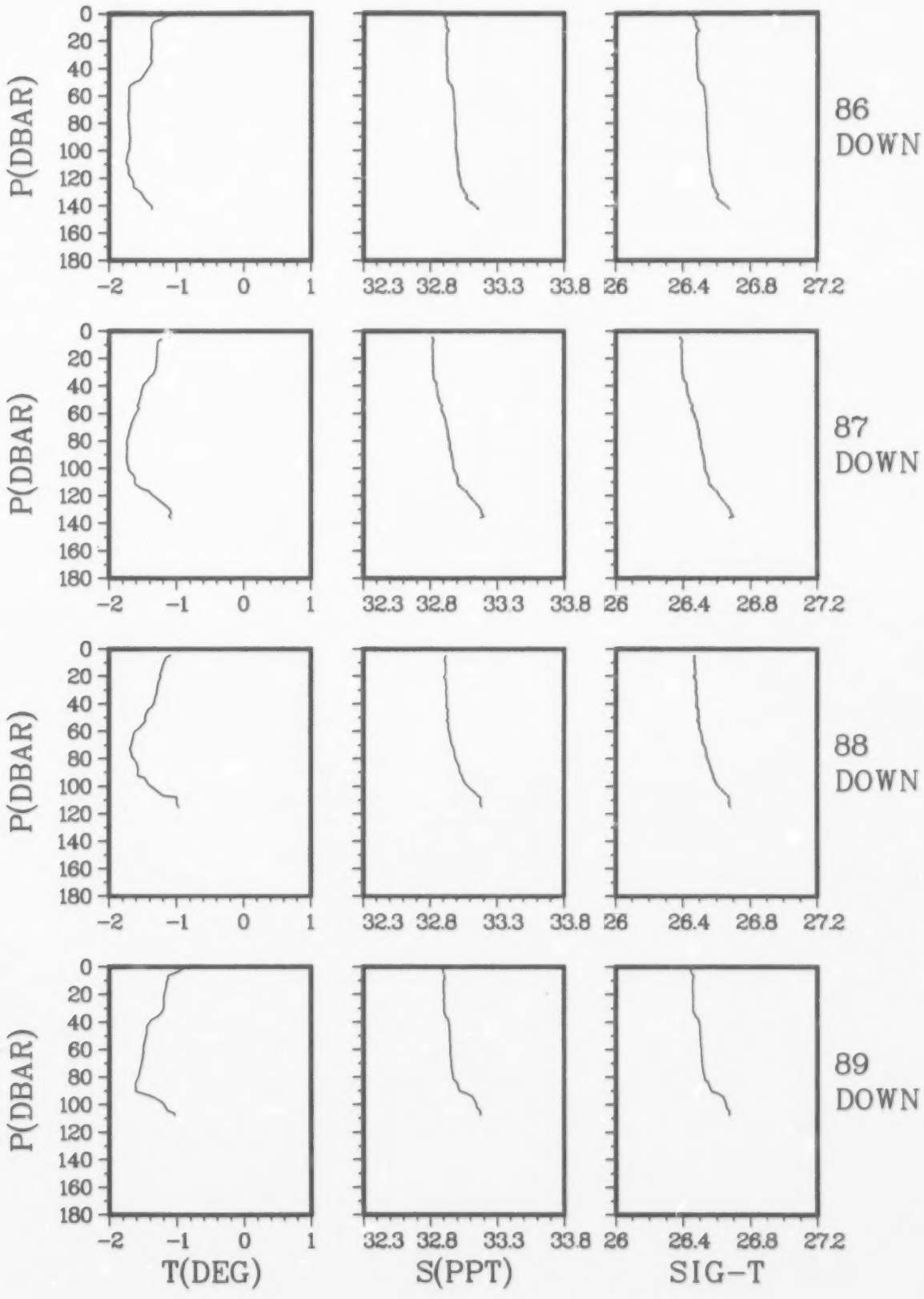

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
66
DOWN
67
DOWN
68
DOWN
69
DOWN
T(DEG)
S(PPT)
SIG-T

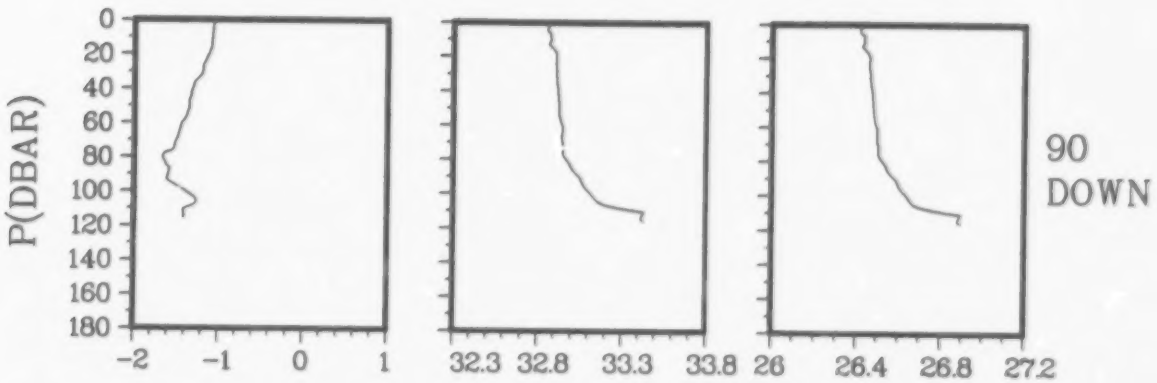

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
70
DOWN
71
DOWN
72
DOWN
73
DOWN
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
74
DOWN
75
DOWN
76
DOWN
77
DOWN
T(DEG)
S(PPT)
SIG−T

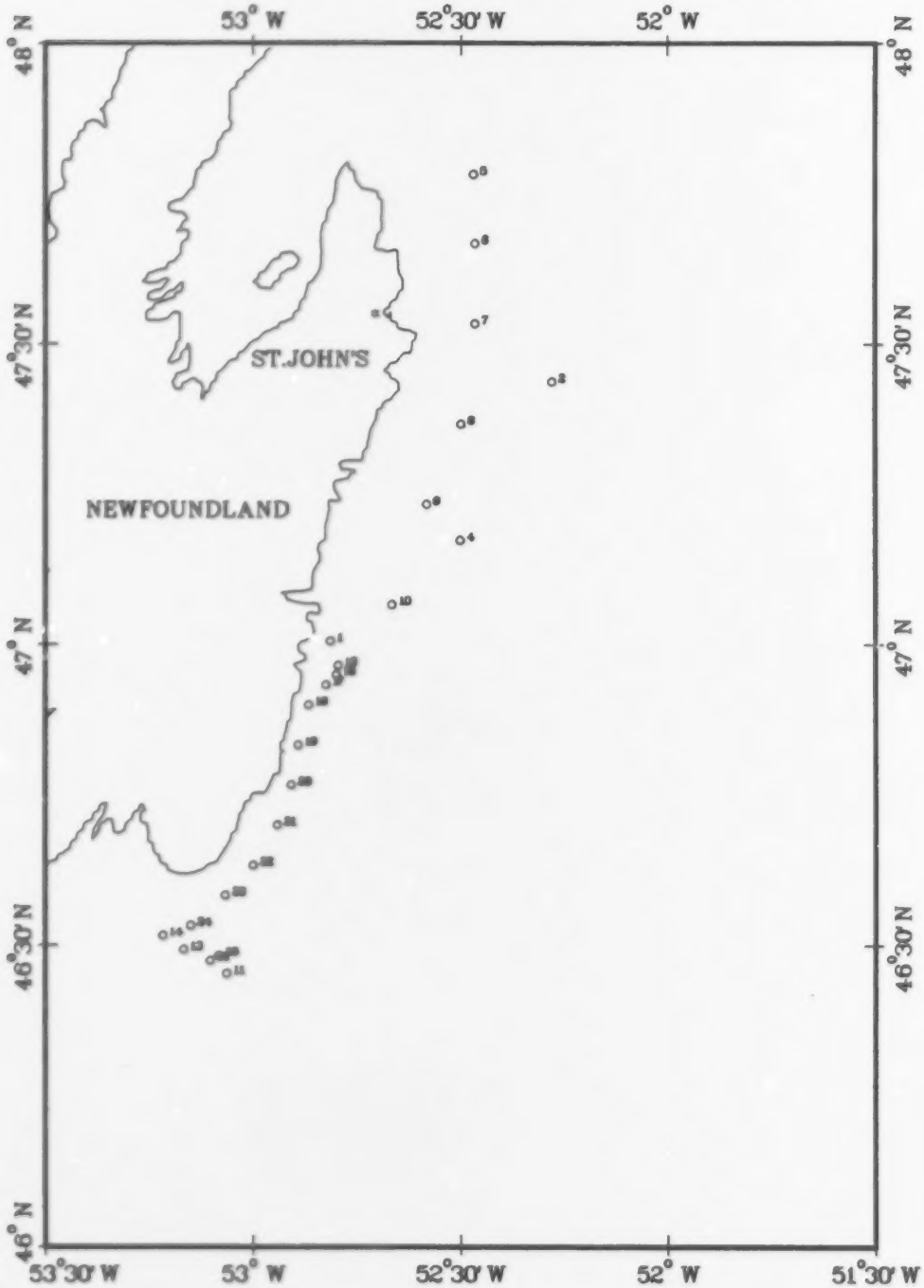

P(DBAR)
0
20
40
60
80
100
120
140
160
180
-2
-1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
78
DOWN
79
DOWN
80
DOWN
81
DOWN
T(DEG)
S(PPT)
SIG-T


P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
82
DOWN
83
DOWN
84
DOWN
85
DOWN
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
86
DOWN
87
DOWN
88
DOWN
89
DOWN
T(DEG)
S(PPT)
SIG−T

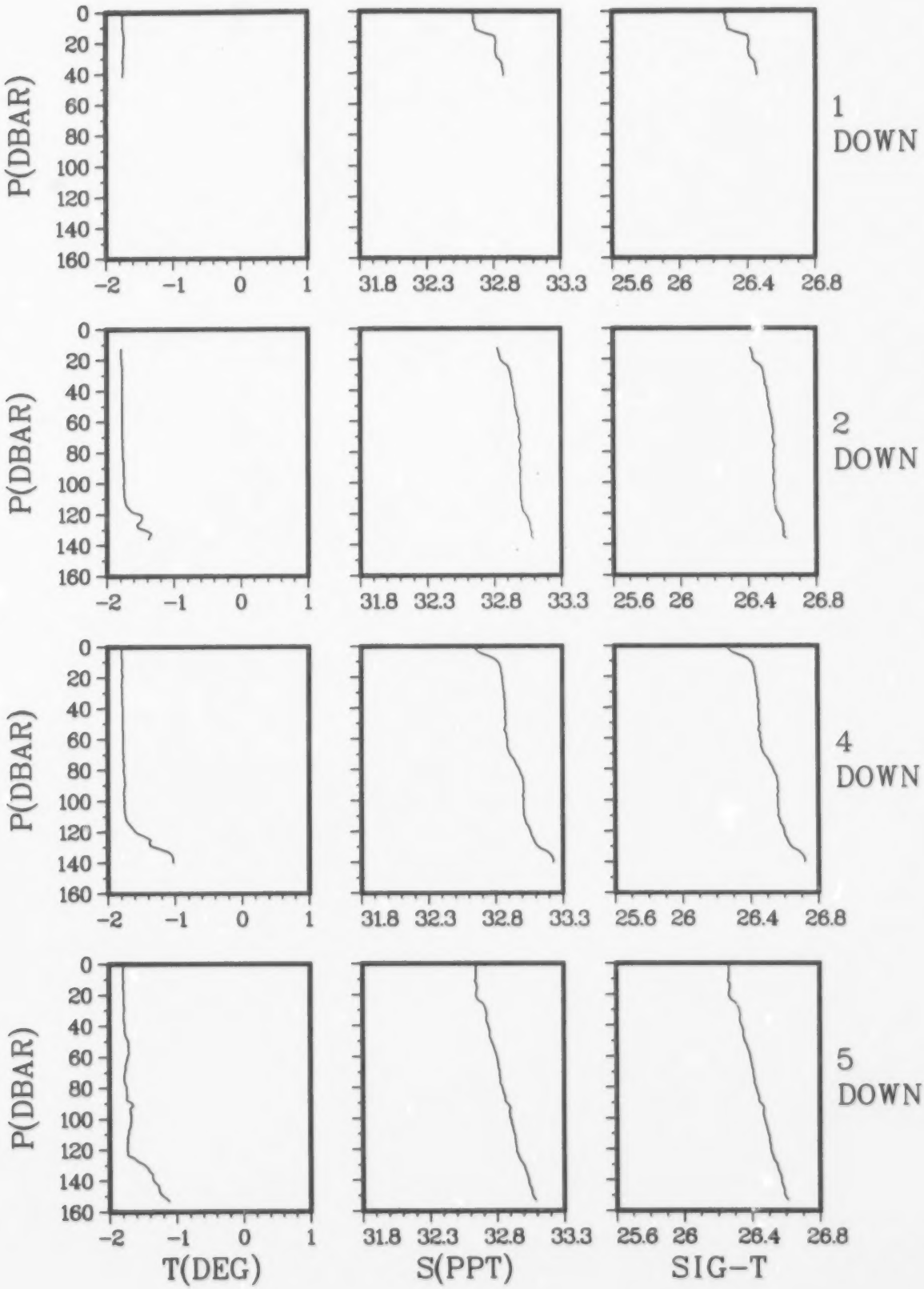

P(DBAR)
0
20
40
60
80
100
120
140
160
180
−2
−1
0
1
32.3
32.8
33.3
33.8
26
26.4
26.8
27.2
90
DOWN

87002 ICE CTD STATIONS



CRUISE 87002 CTD STATIONS
[ICE CTD]

STN	DAY	TIME	LATITUDE	LONGITUDE
1	75	13:40	47.006	52.814
2	79	11:30	47.437	52.282
4	80	14:30	47.174	52.502
5	82	14:30	47.782	52.470
6	82	18:10	47.667	52.467
7	82	19:10	47.533	52.467
8	82	19:50	47.367	52.500
9	82	20:20	47.233	52.583
10	82	21:00	47.067	52.667
11	84	17:30	46.453	53.063
12	84	18:00	46.475	53.103
13	84	18:30	46.493	53.167
14	84	19:00	46.517	53.217
15	85	14:32	46.966	52.796
16	85	16:30	46.950	52.800
17	85	17:00	46.933	52.825
18	85	17:30	46.900	52.867
19	85	18:00	46.833	52.892
20	85	18:30	46.767	52.908
21	85	19:00	46.700	52.942
22	85	19:30	46.633	53.000
23	85	20:00	46.583	53.067
24	85	20:30	46.533	53.150
25	85	21:00	46.483	53.083


P(DBAR)
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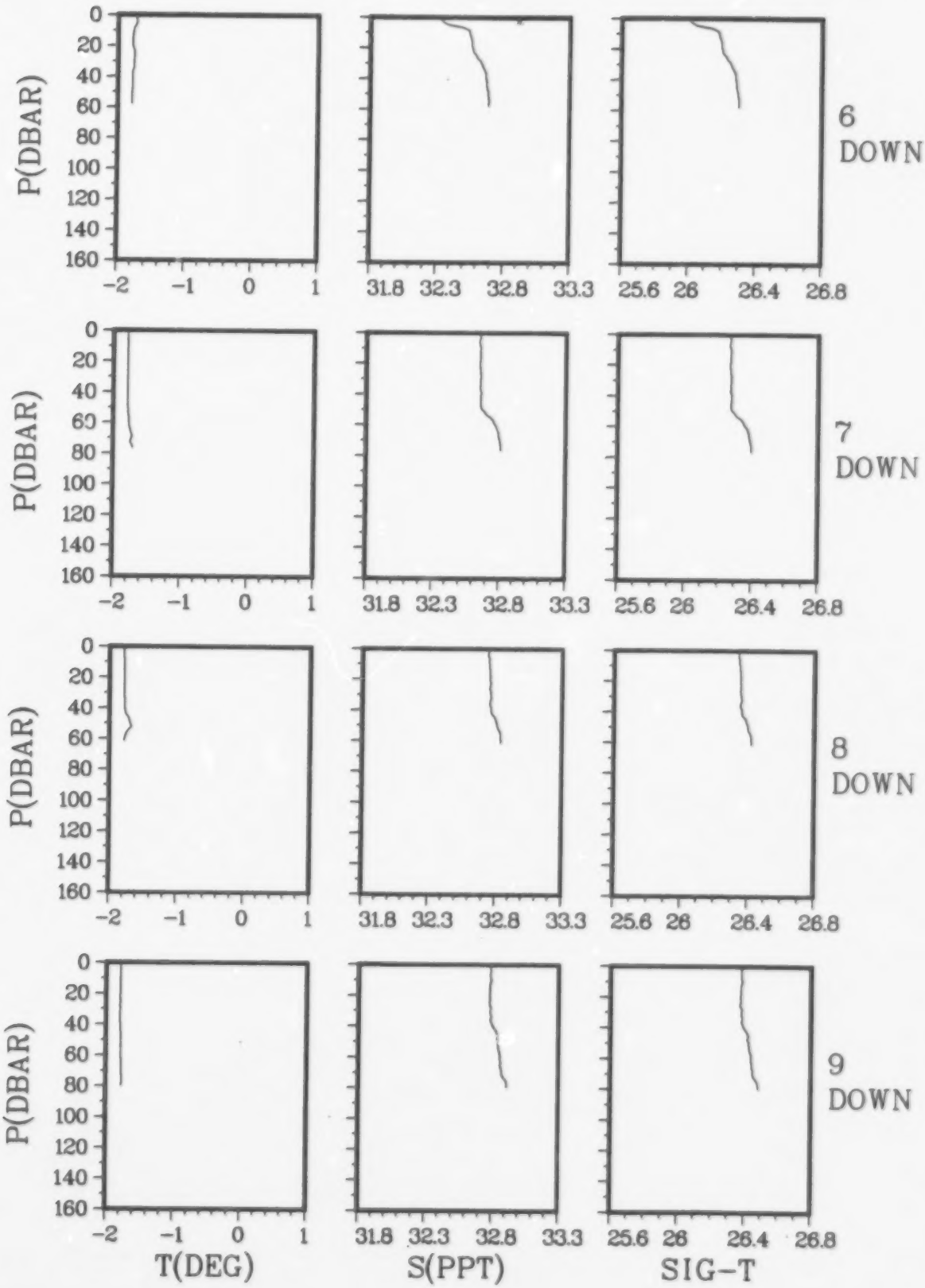
20
40
60
80
100
120
140
160
-2
-1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
1
DOWN
2
DOWN
4
DOWN
5
DOWN
T(DEG)
S(PPT)
SIG-T


P(DBAR)
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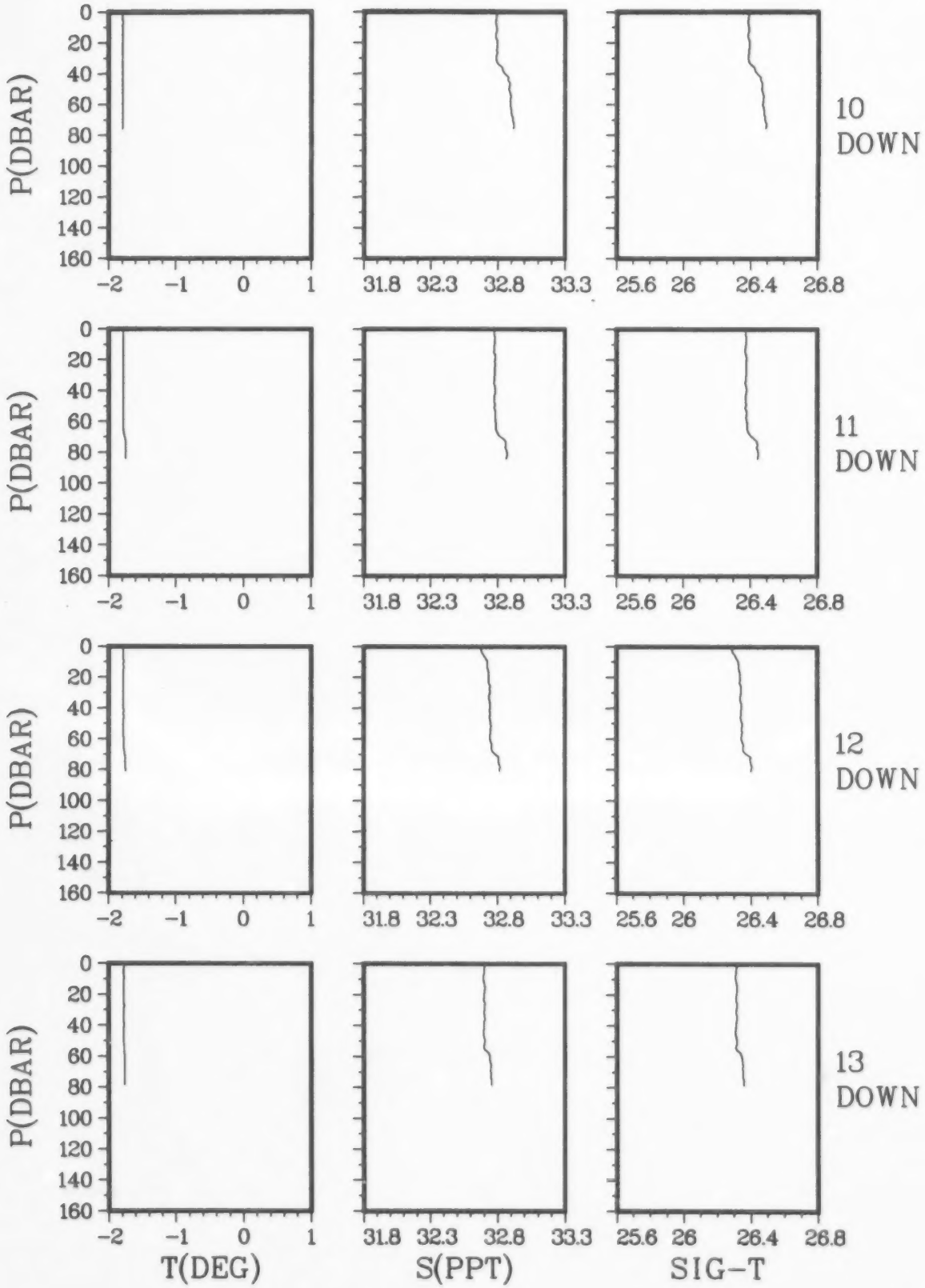
20
40
60
80
100
120
140
160
-2
-1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
6
DOWN
7
DOWN
8
DOWN
9
DOWN
T(DEG)
S(PPT)
SIG-T


P(DBAR)
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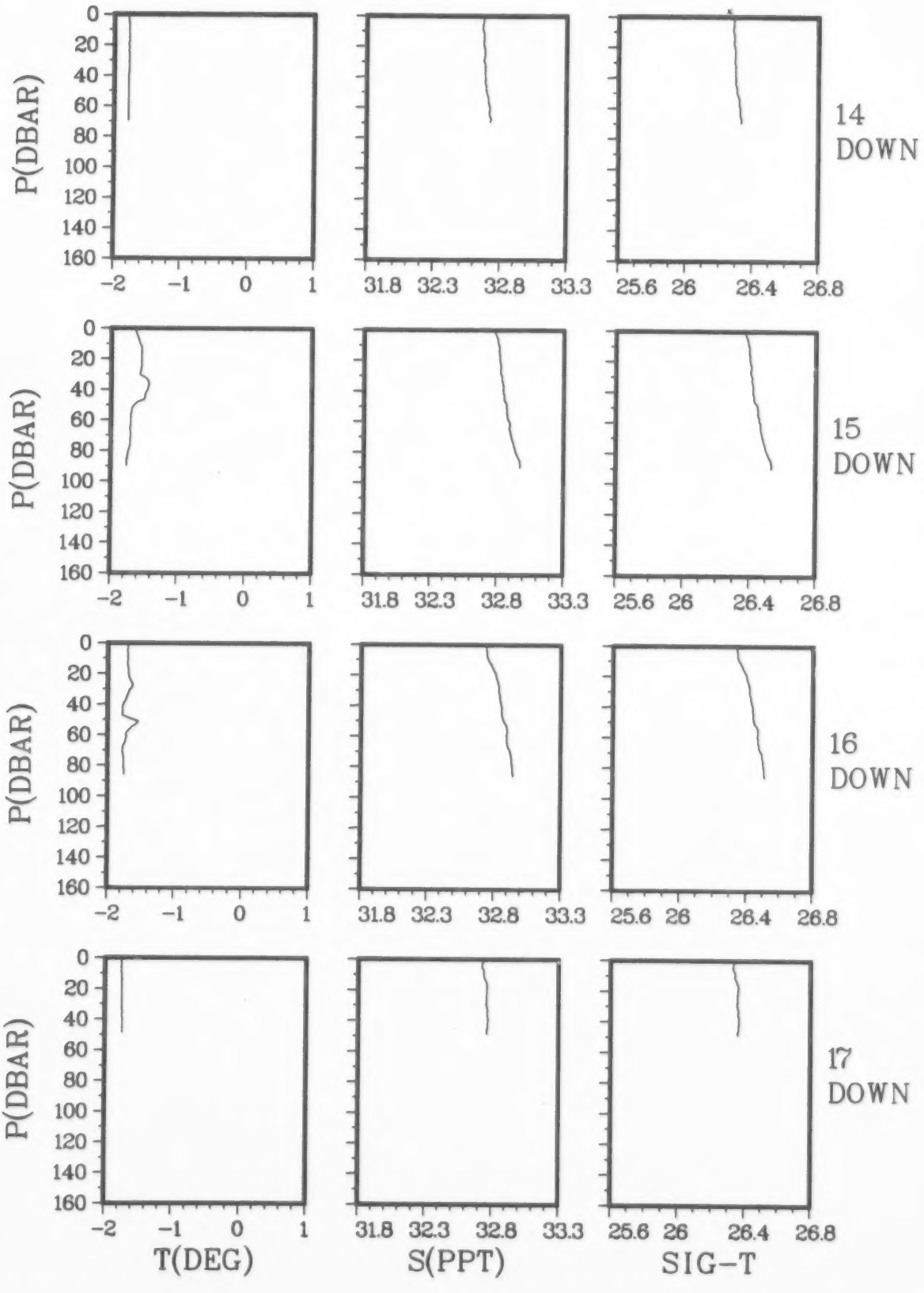
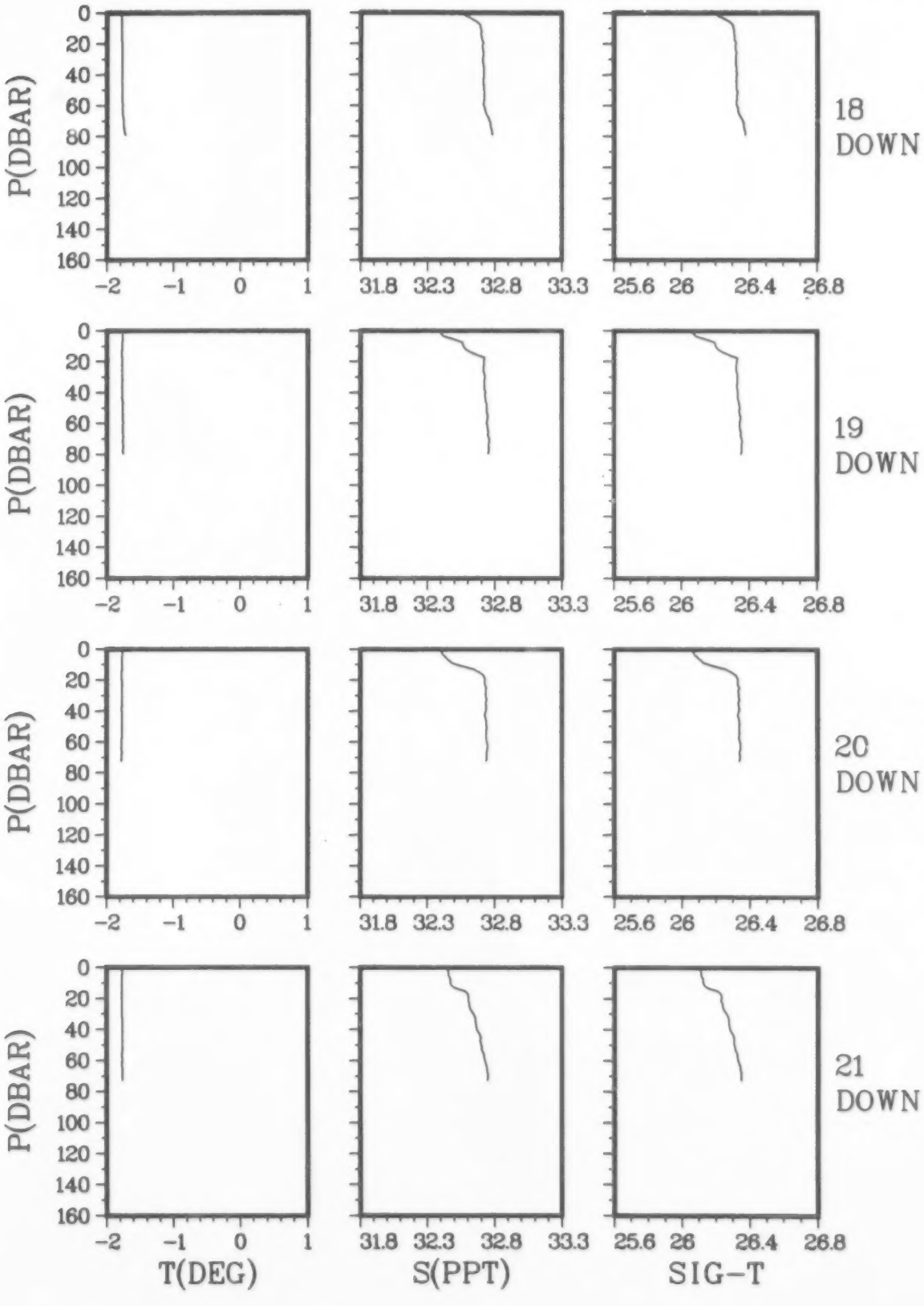
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
10
DOWN
11
DOWN
12
DOWN
13
DOWN
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
14
DOWN
15
DOWN
16
DOWN
17
DOWN
T(DEG)
S(PPT)
SIG−T


P(DBAR)
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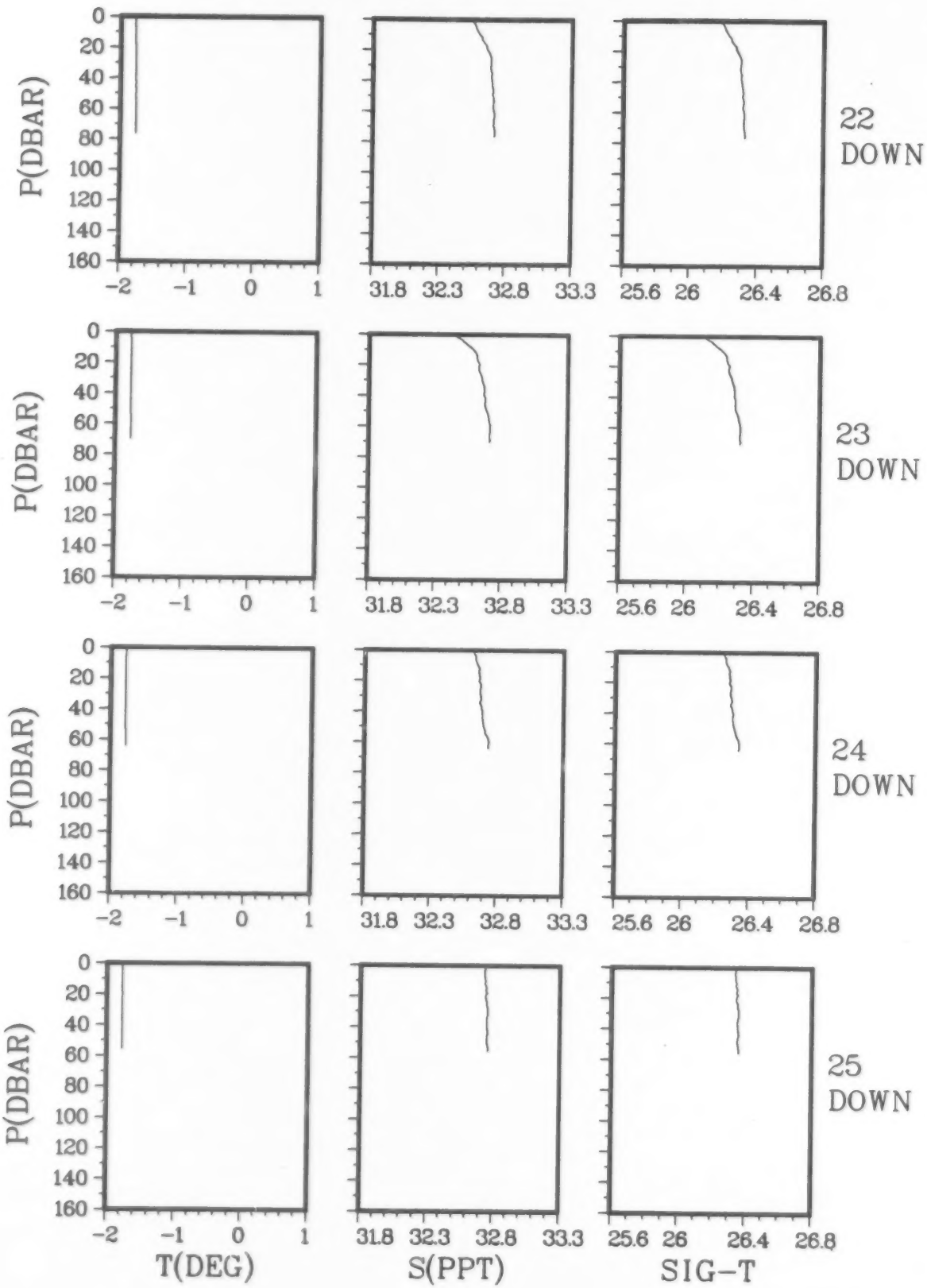
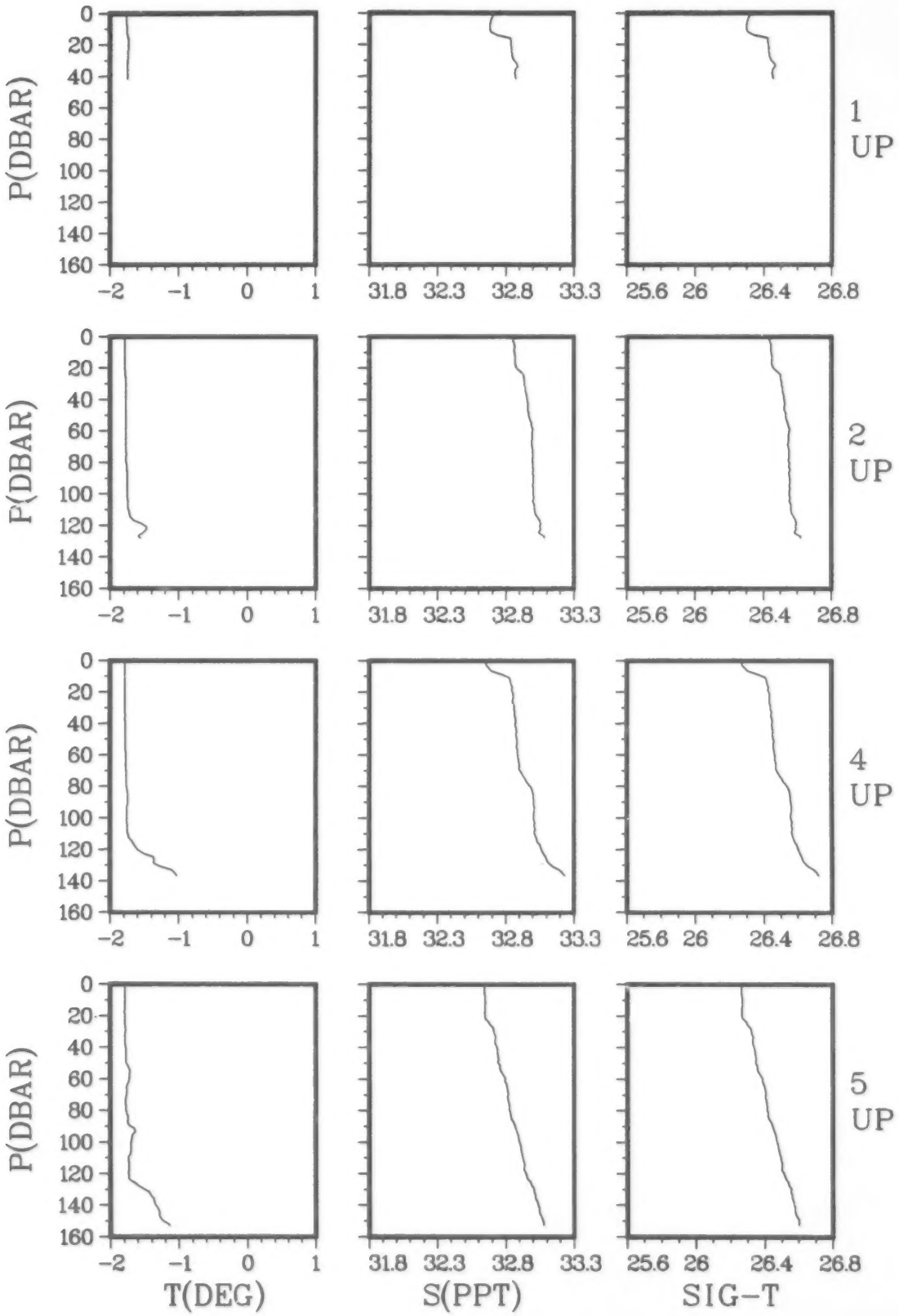
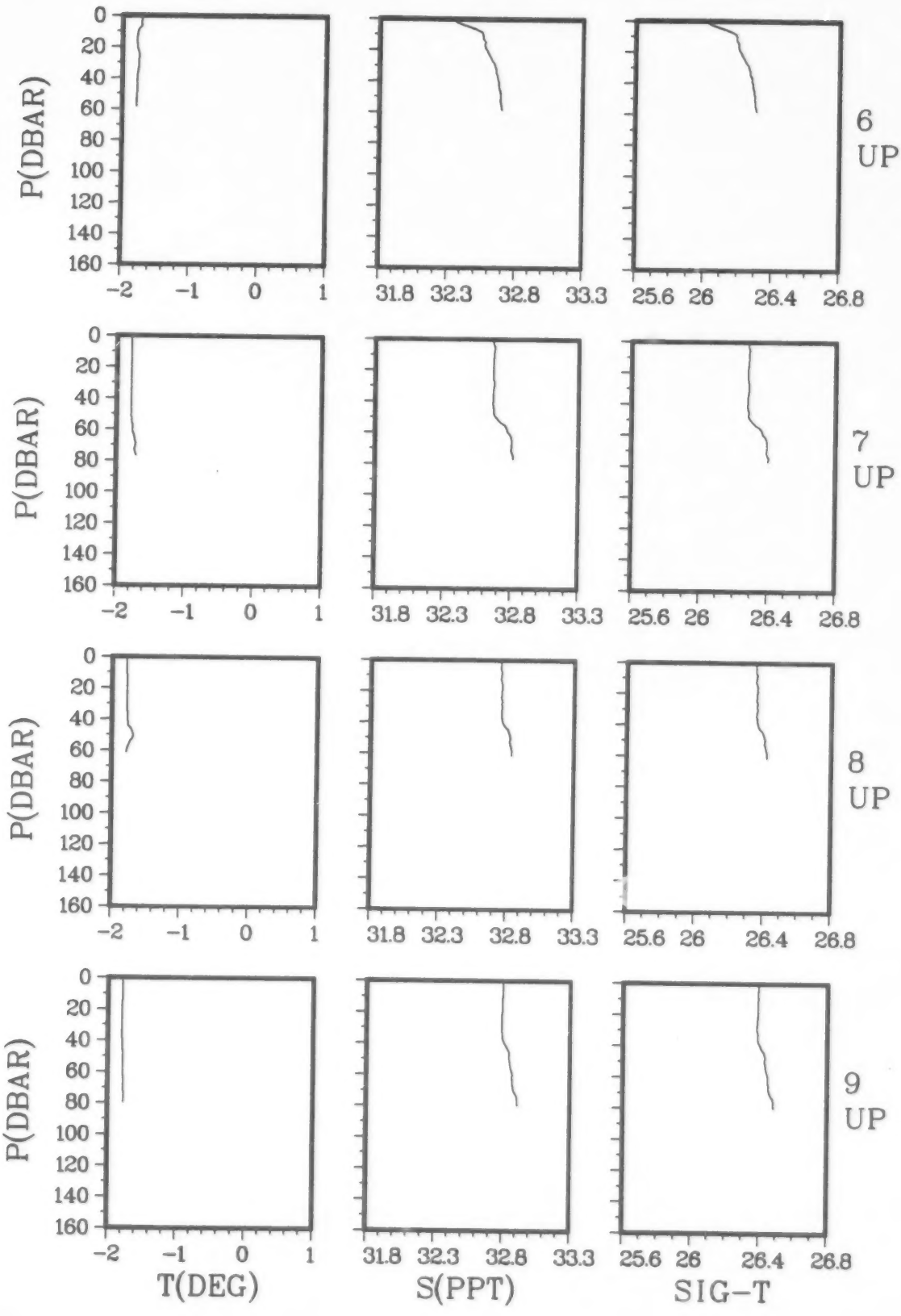
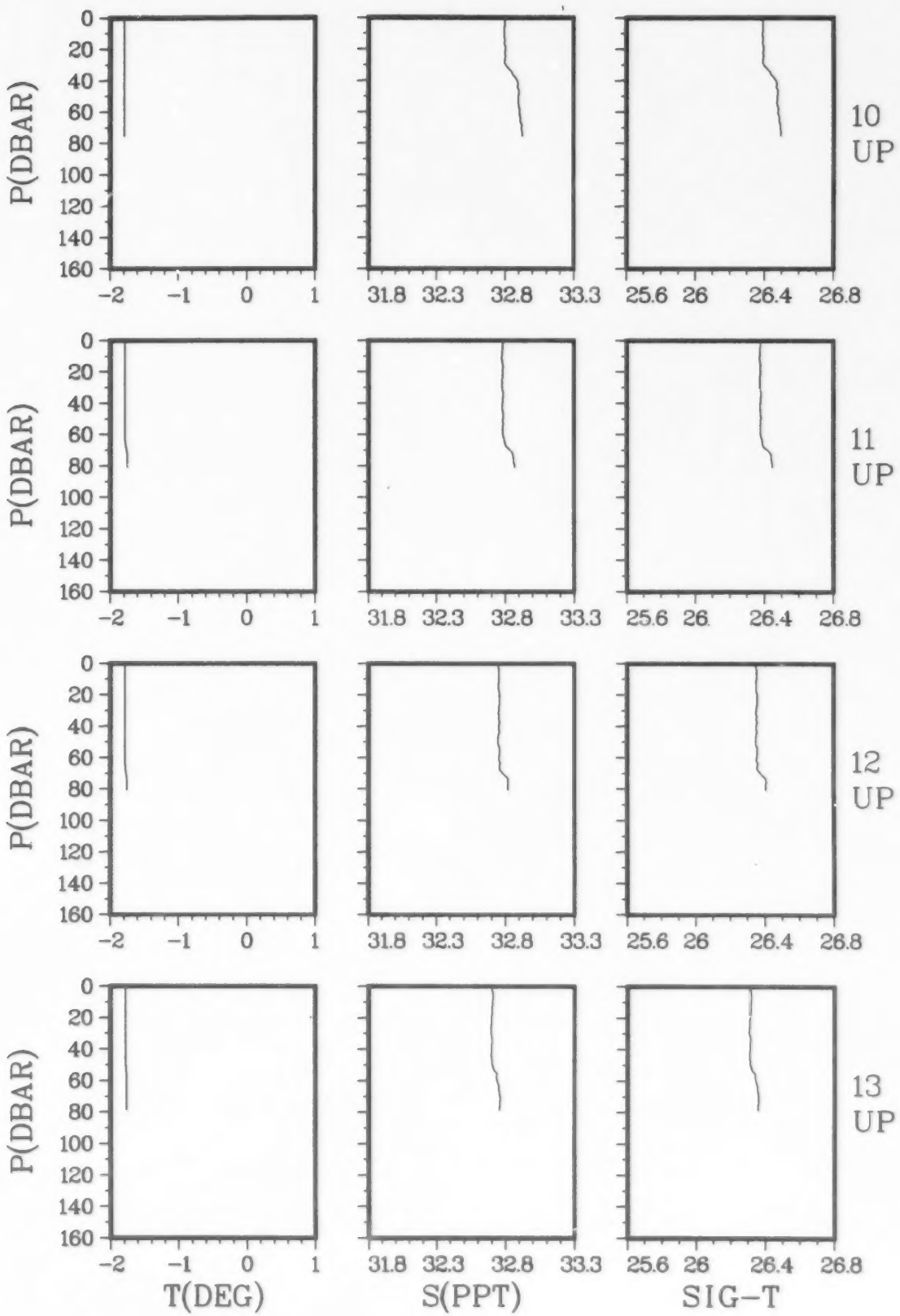
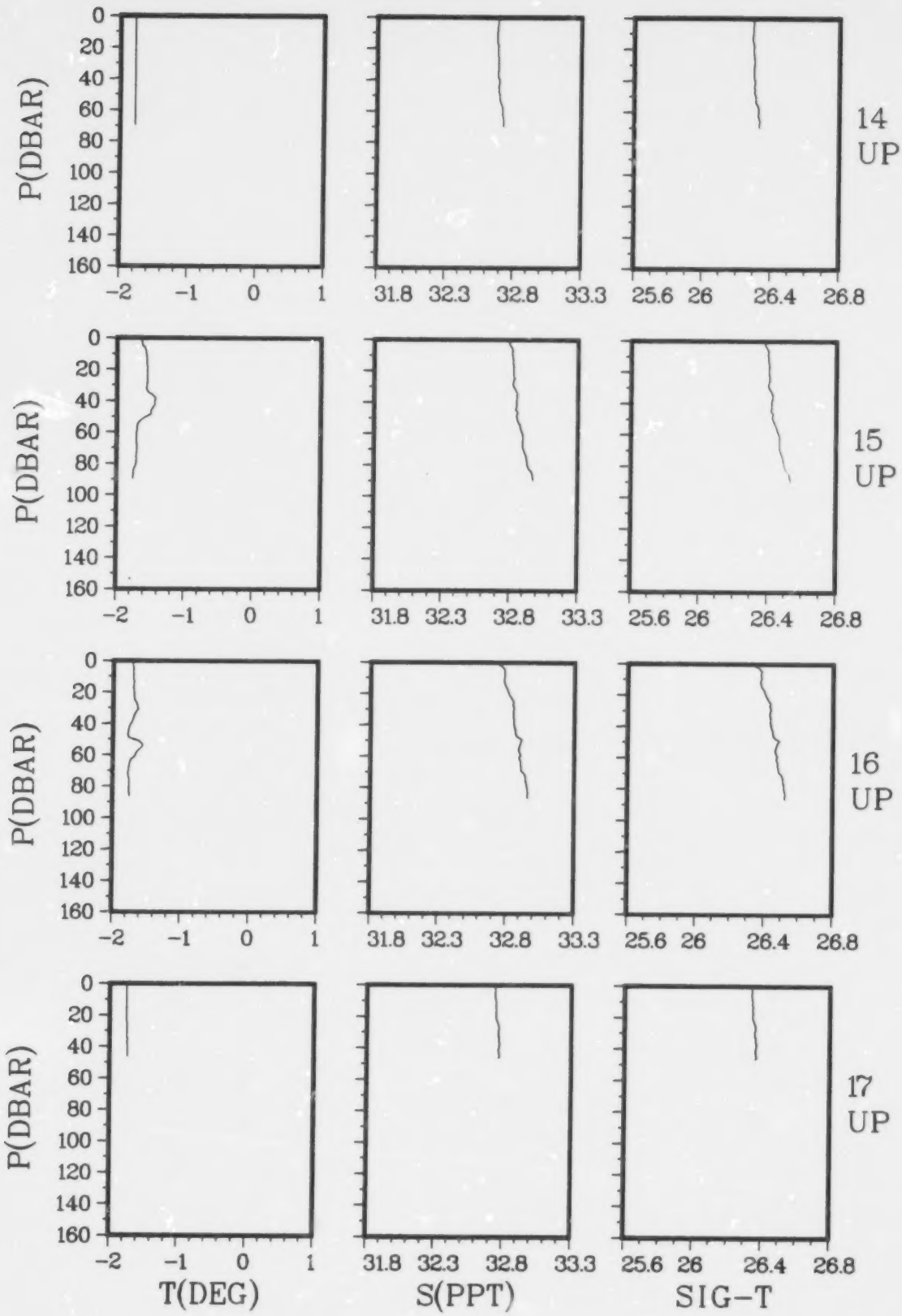
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
18
DOWN
19
DOWN
20
DOWN
21
DOWN
T(DEG)
S(PPT)
SIG−T

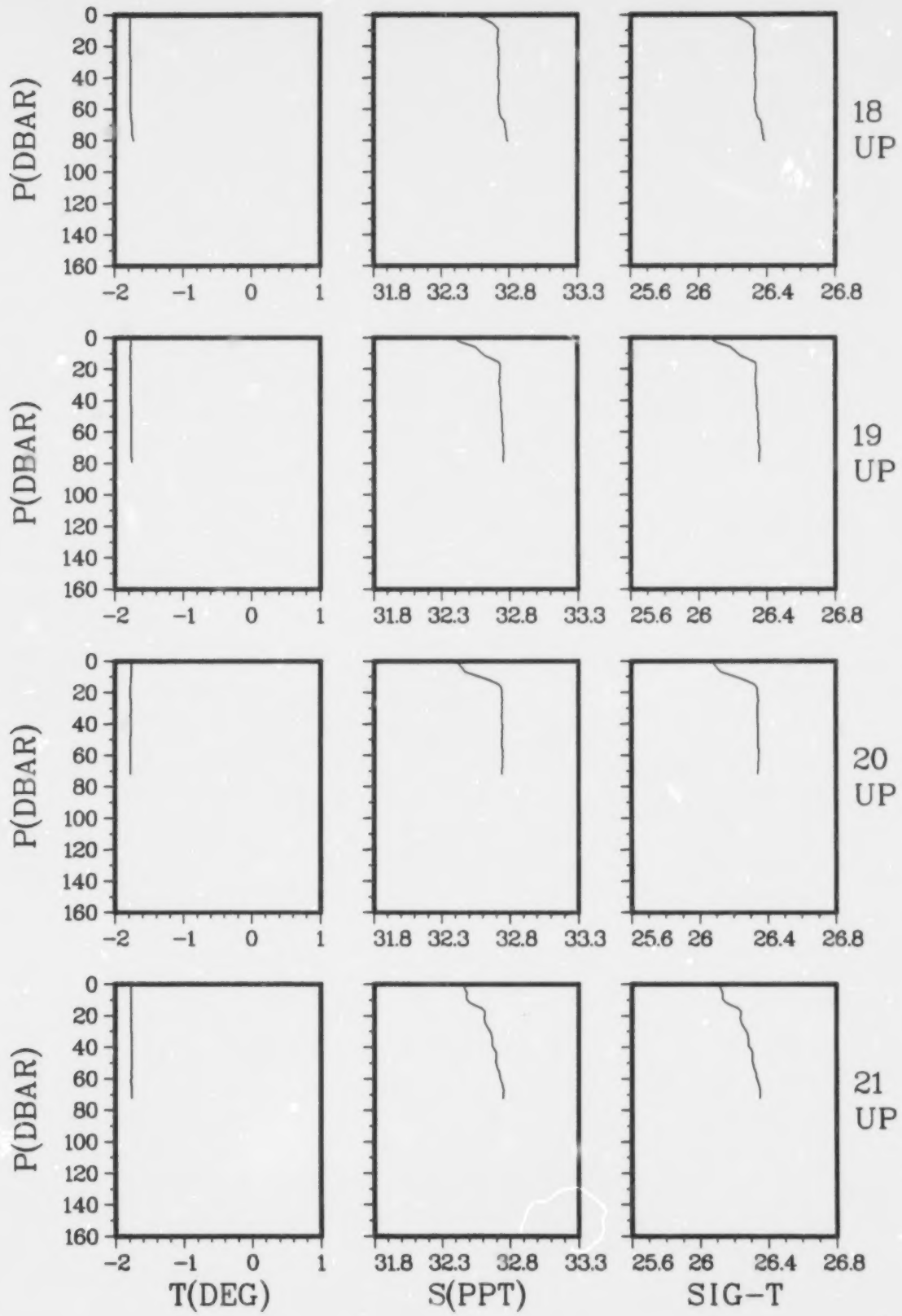

P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
22
DOWN
23
DOWN
24
DOWN
25
DOWN
T(DEG)
S(PPT)
SIG−T

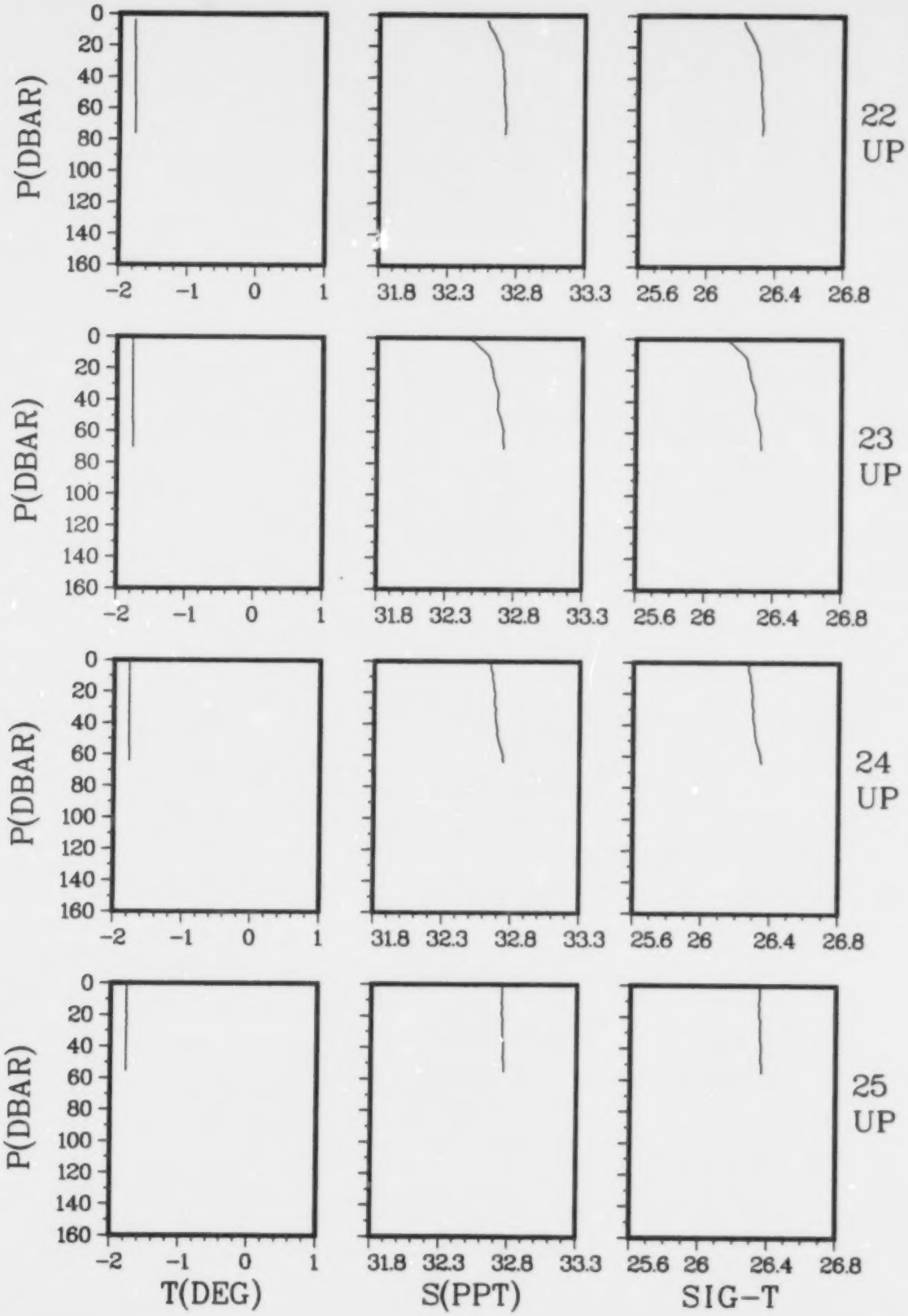

P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
1
UP
2
UP
4
UP
5
UP
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
6
UP
7
UP
8
UP
9
UP
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
10
UP
11
UP
12
UP
13
UP
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
14
UP
15
UP
16
UP
17
UP
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
18
UP
19
UP
20
UP
21
UP
T(DEG)
S(PPT)
SIG−T


P(DBAR)
0
20
40
60
80
100
120
140
160
−2
−1
0
1
31.8
32.3
32.8
33.3
25.6
26
26.4
26.8
22
UP
23
UP
24
UP
25
UP
T(DEG)
S(PPT)
SIG−T

8. Current under ice

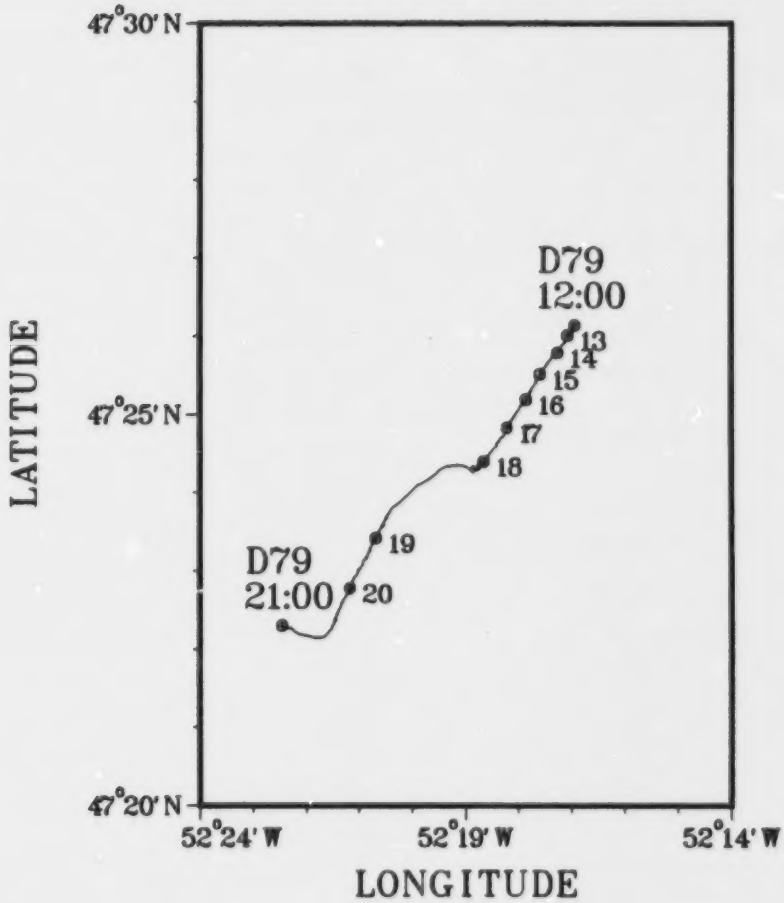
An S4 electromagnetic current meter was used at three ice stations (see pp.75 and 76, and pp.91 and 92 for locations) to measure current under the ice. The instrument and personnel were deployed from the ship. A 12" hole through the ice was drilled using a gasoline- powered ice auger. The S4 was attached to the end of the calble from a portable winch and lowered into the water through the hole. The operation was conducted in two modes: discrete and continuous. In the discrete mode, the S4 was stopped at predetermined depths for approximately 5 minutes. In the continuous mode, the instrument was lowered and then raised at a mean speed of 1.7 meters per minute and 1.0 meters per minute respectively. The sampling interval is 5 s in both modes. A summary of the five S5 casts is given below (Julian day in bracket).

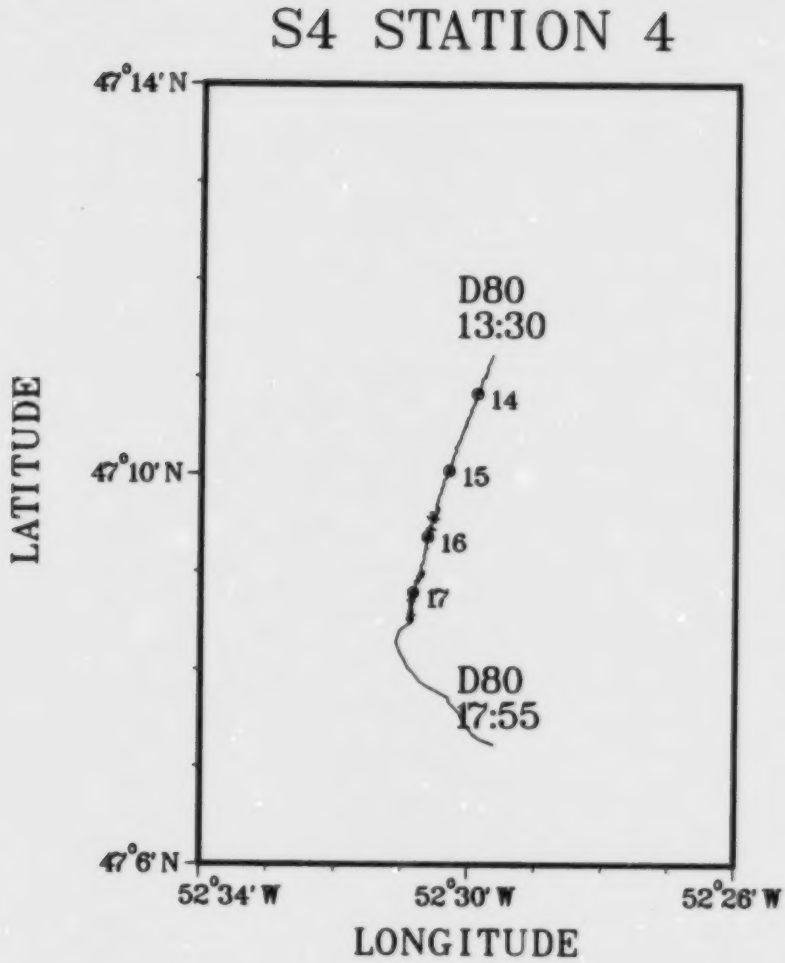
Station	Cast	Mode	Date	Time (GMT)	Max.depth(m)
2	1	discrete	87/3/20(79)	13:27-14:39	127
3	2	discrete	87/3/20(79)	19:51-20:22	90
4	3	discrete	87/3/21(80)	13:57-15:21	118
4	4	continuous down	87/3/21(80)	15:26-15:48	37
4	4	continuous up	87/3/21(80)	15:48-16:12	37

The ship was drifting with the ice while the profiles were taken. The positions of the ship during the measurement are shown in pp. 91 and 92.

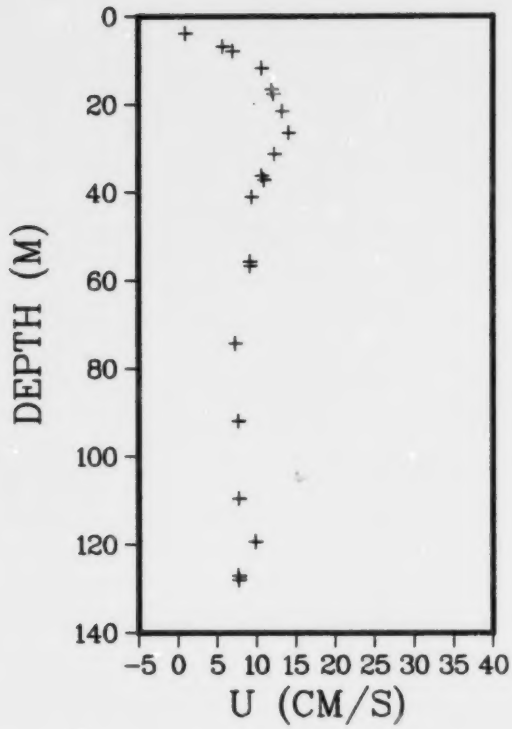
The east component (U), north component (V), speed and direction versus depth are shown in pp.93 to 102. For Cast 1 to 3, the plotted values are vector averages at given depths with outliers removed. For Cast 4 (down and up), the plotted values are vector averages of 1 m depth interval. For comparison, the raw data plots are shown in the pages following the mean velocity plots for each cast.

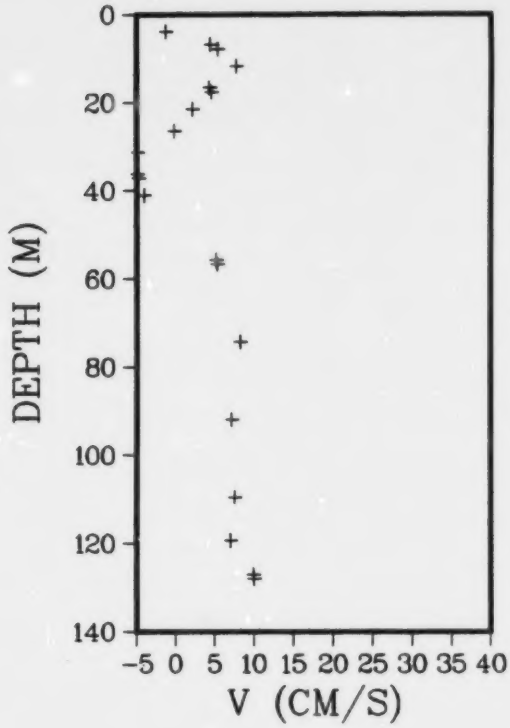
S4 STATIONS 2 & 3

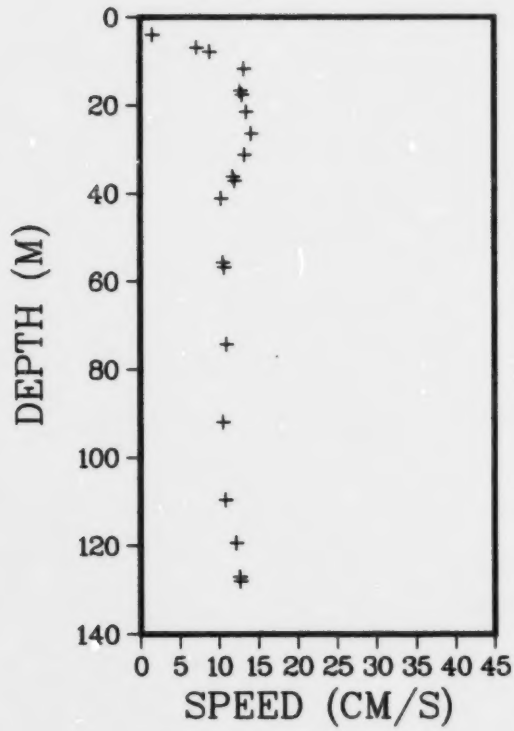


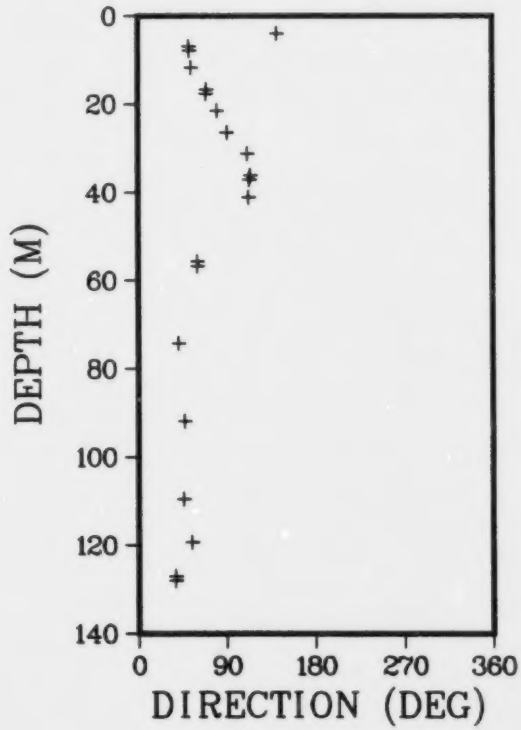

S4 STATION 4
47°14' N
47°10' N
47°6' N
LATITUDE
D80
13:30
14
15
16
17
D80
17:55
52°34' W
52°30' W
52°26' W
LONGITUDE

87/03/20 13:27:20 DOWN CAST1

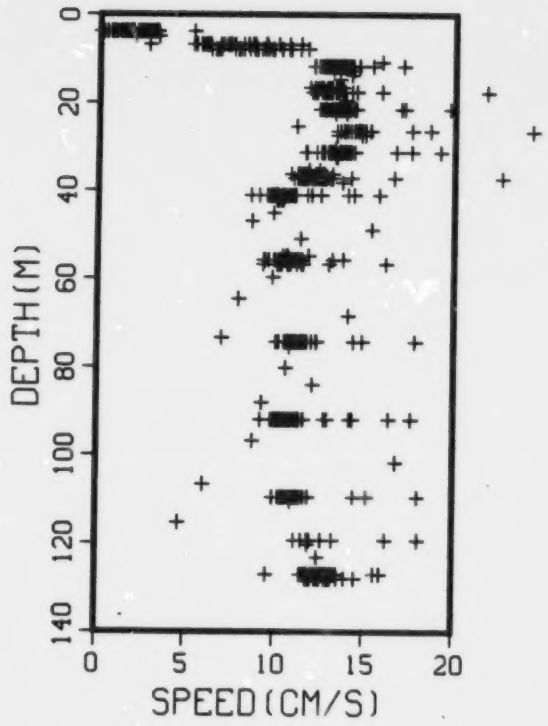


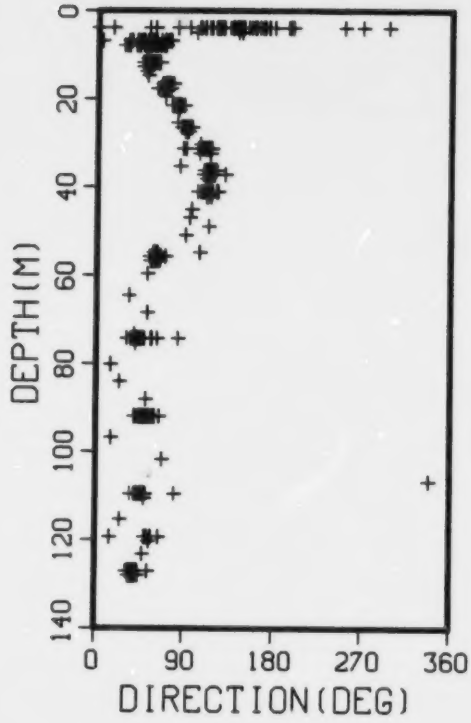


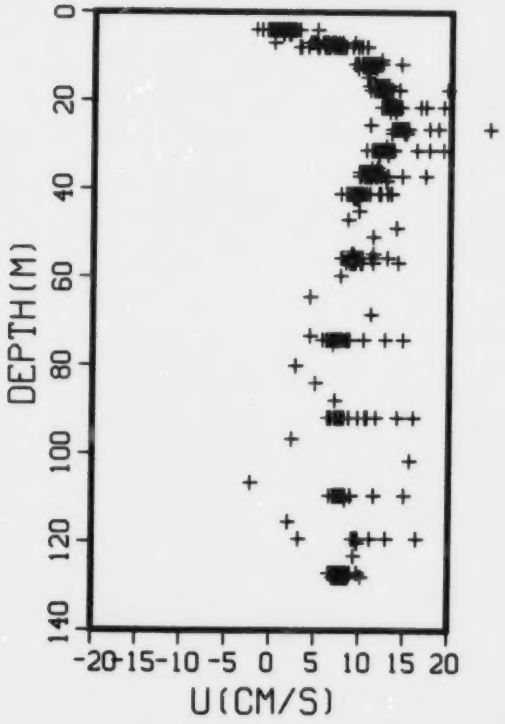


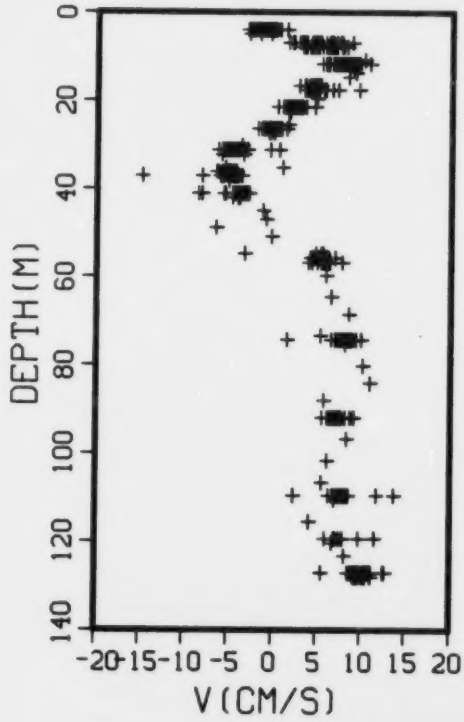


CAST 1 DOWN



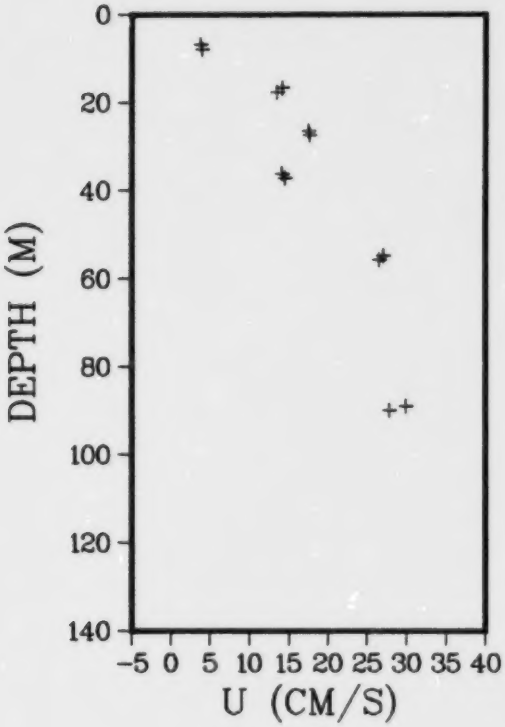


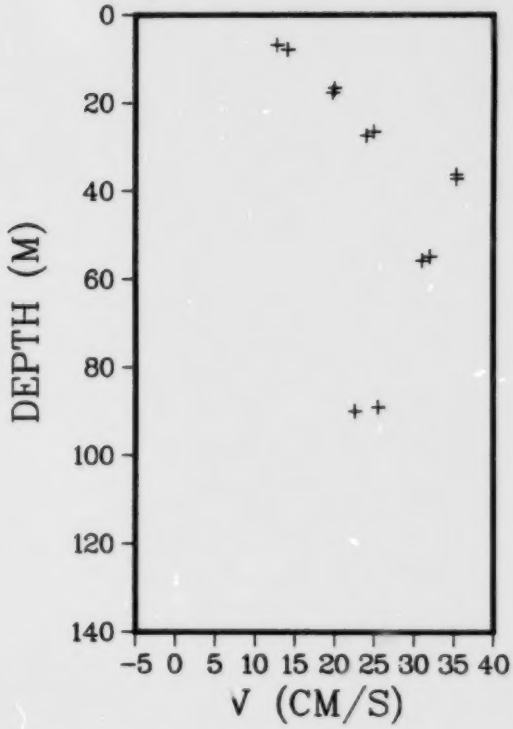


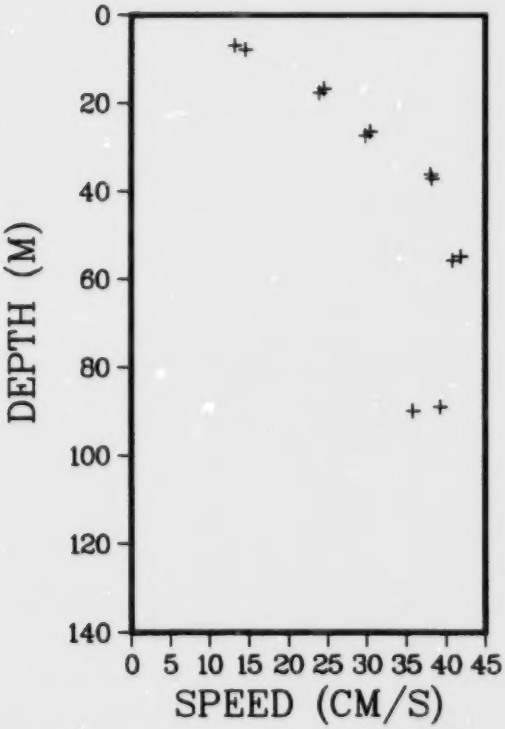


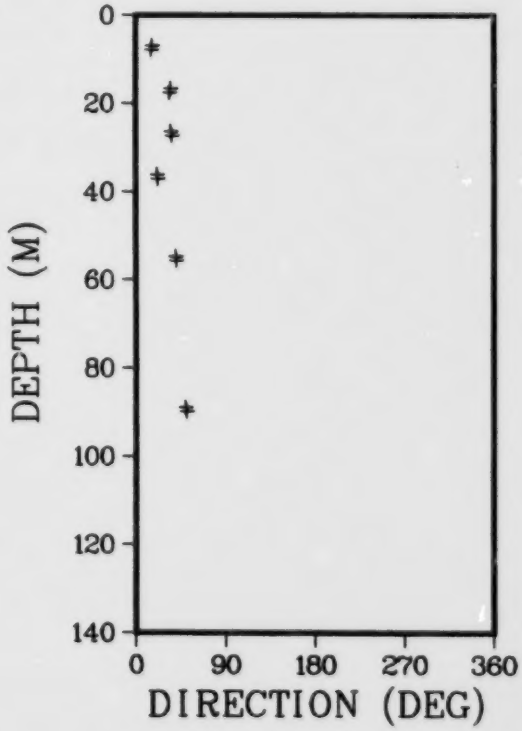
MARCH 20, LINE 1074-1936

87/03/20 19:51:50 DOWN CAST2

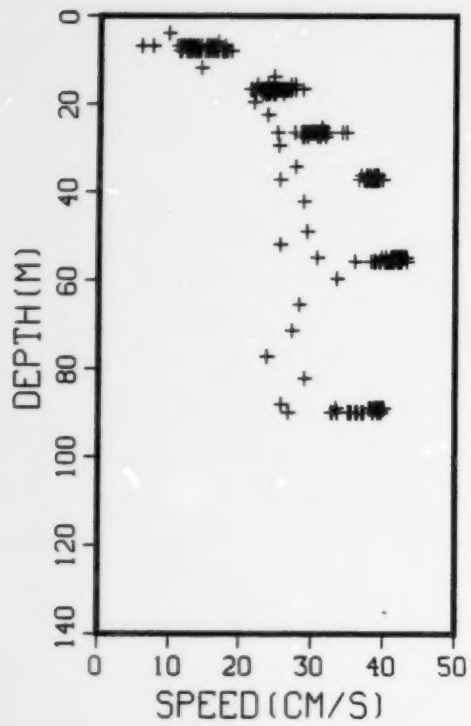


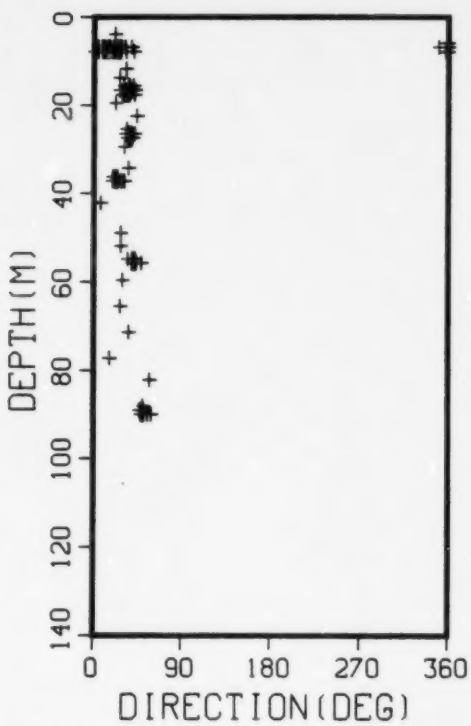


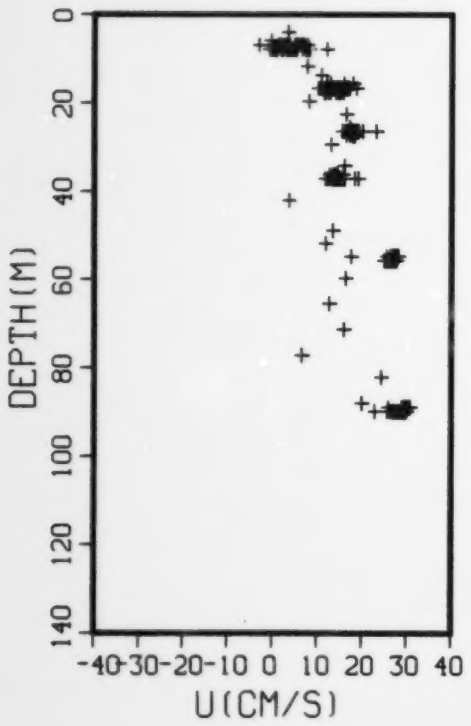


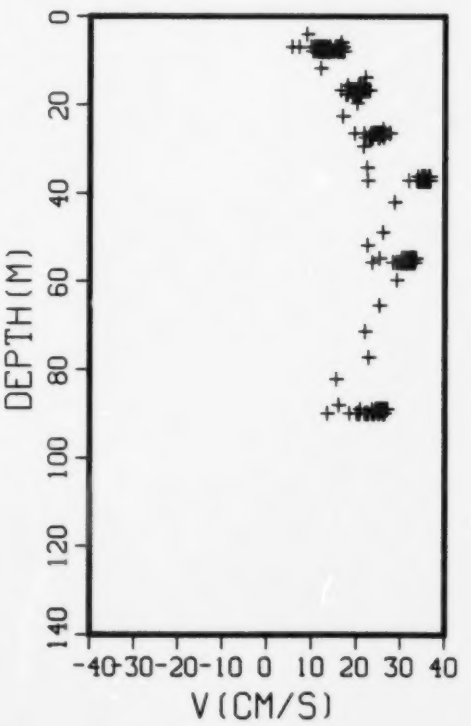


CAST 2 DOWN



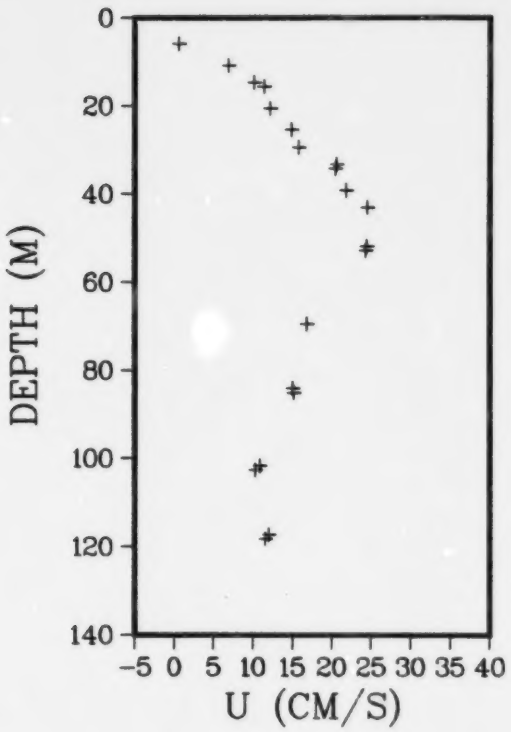


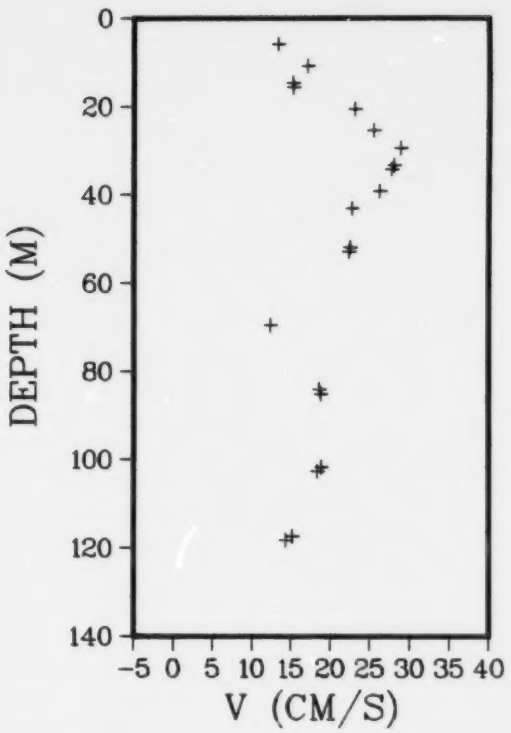


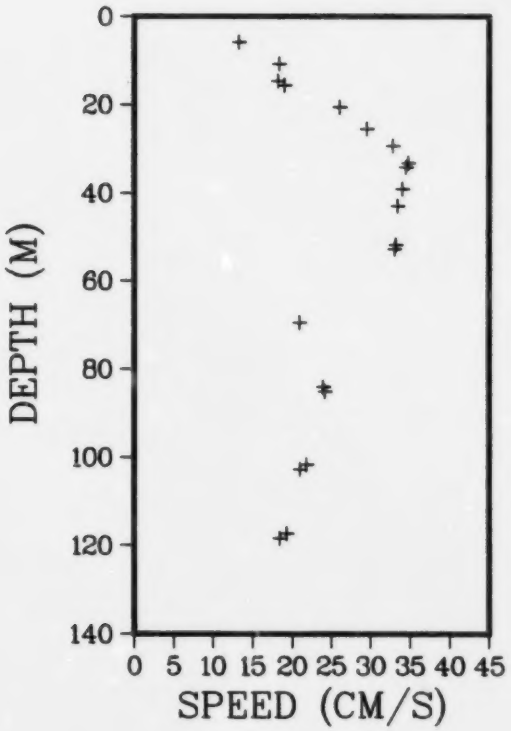


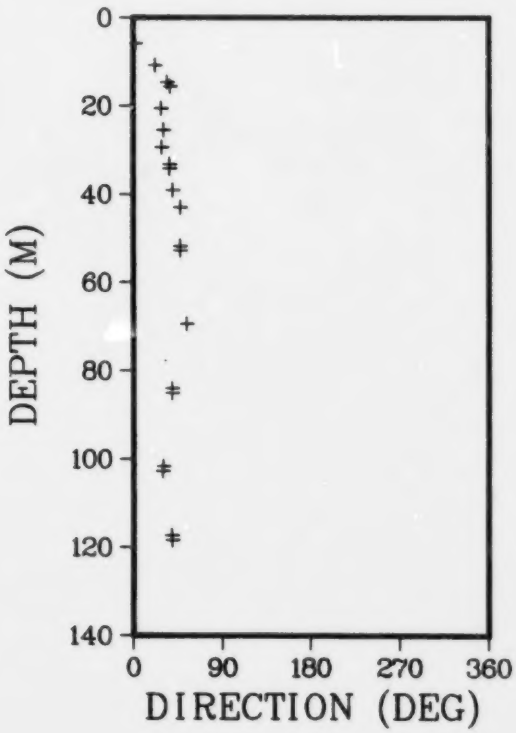
MARCH 20, LINE 5684-6046

87/03/21 13:57:35 DOWN CAST3

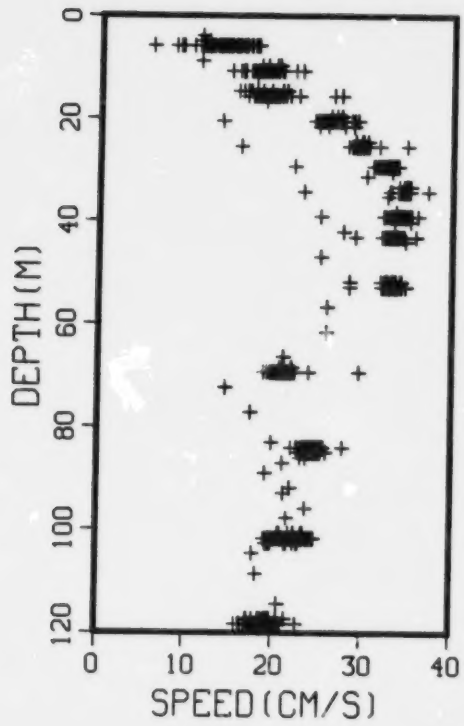


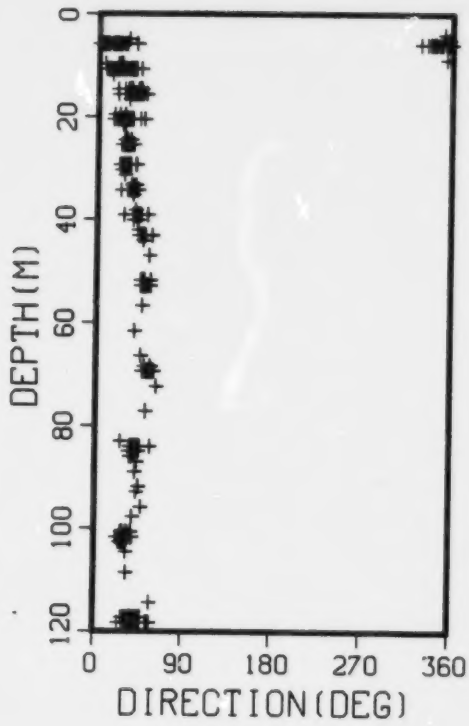


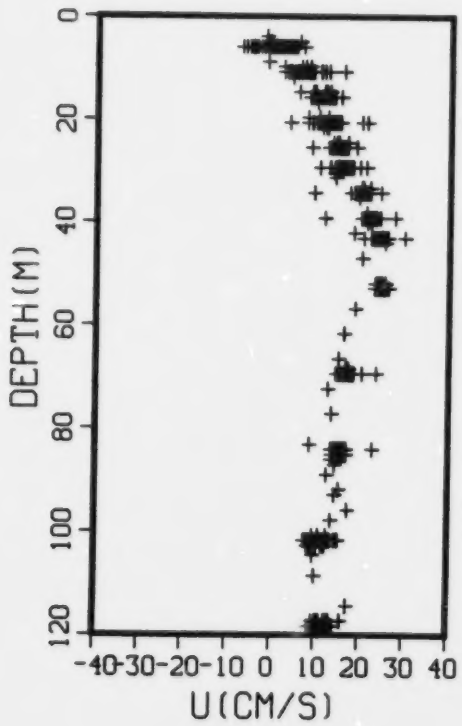


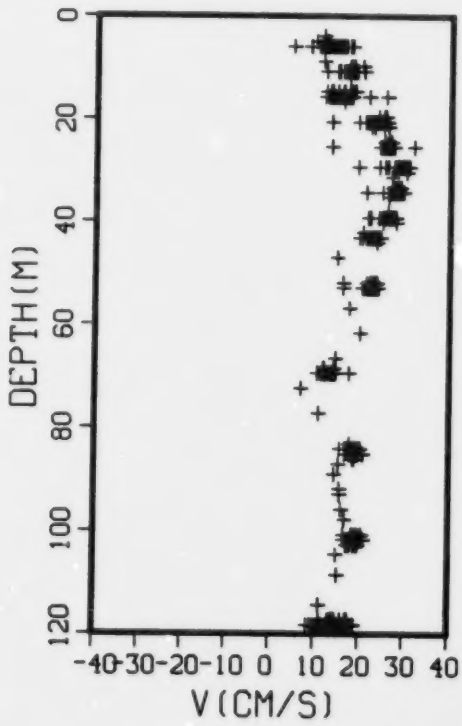


CAST 3 DOWN



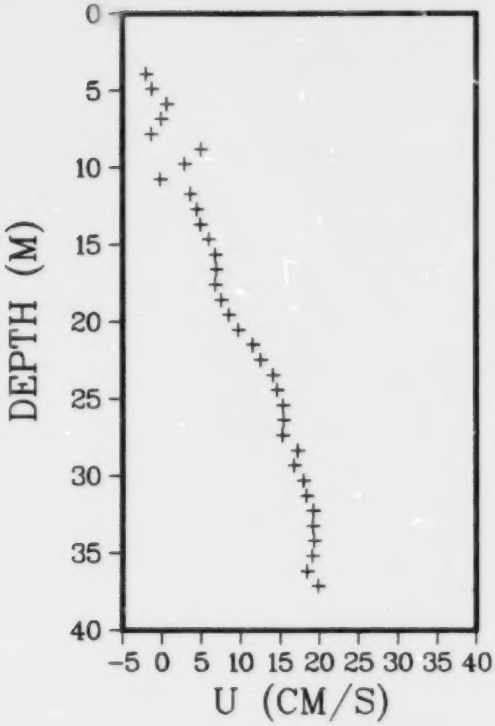


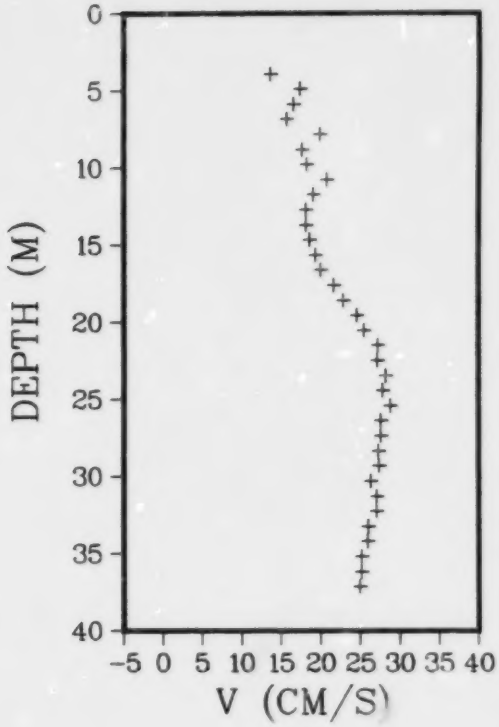


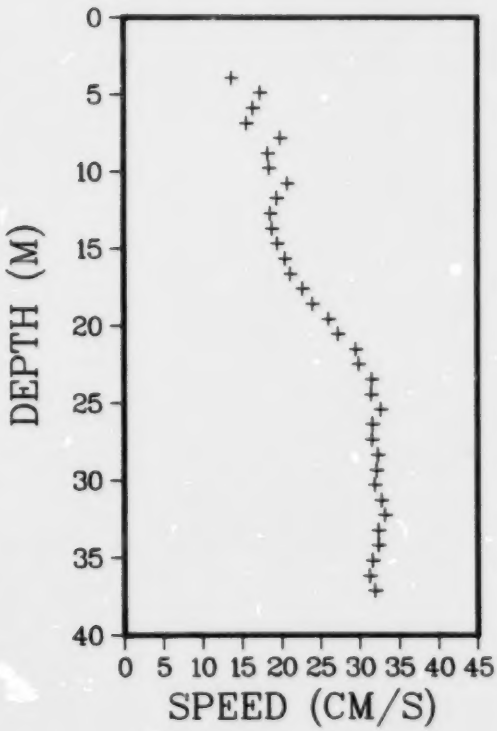


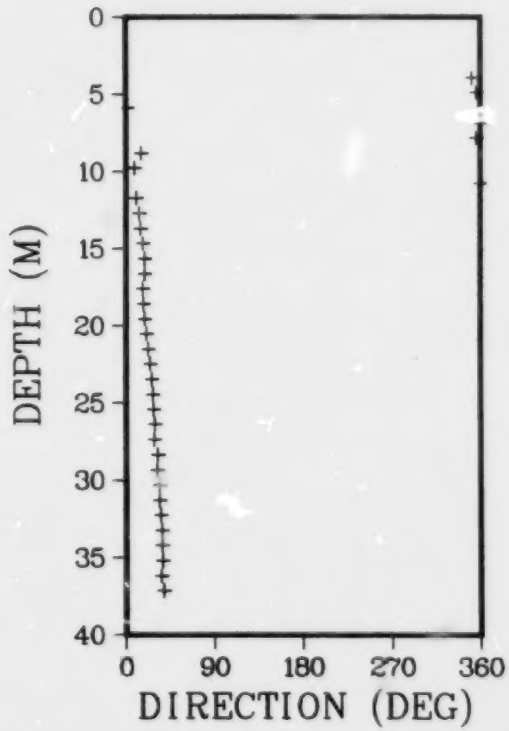
MARCH 21, LINE 0978-1977

87/03/21 15:26:00 DOWN CAST4

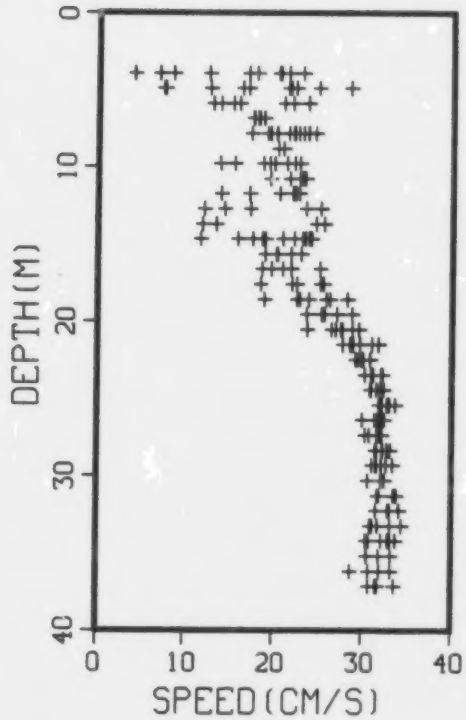


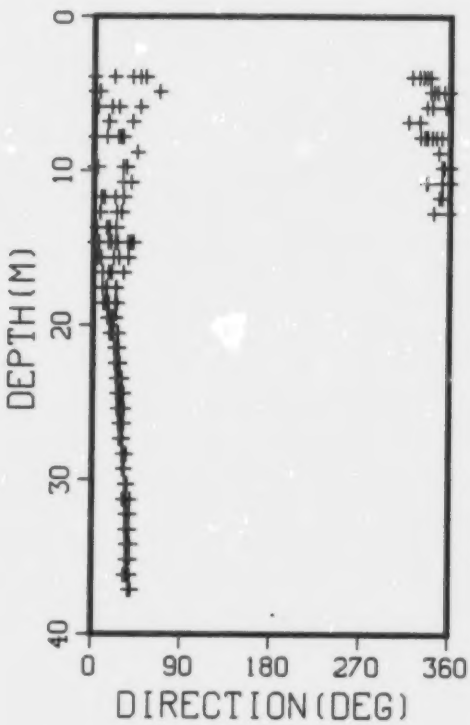


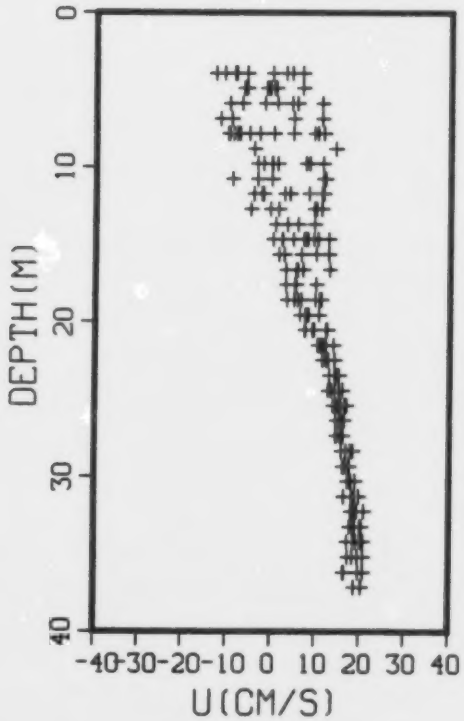


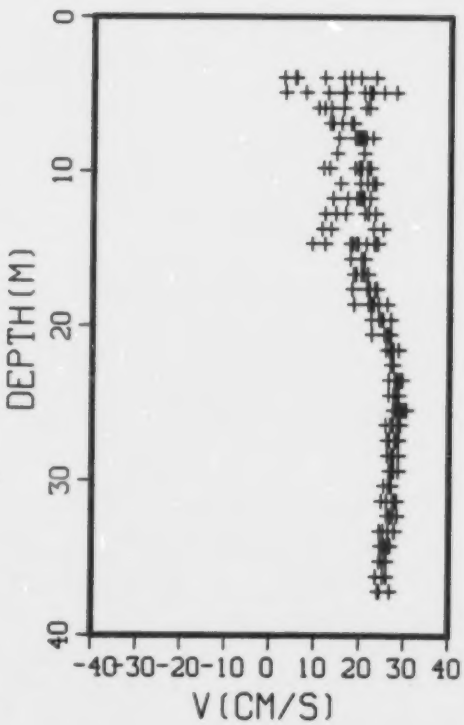


CAST 4 DOWN CONTINUOUS



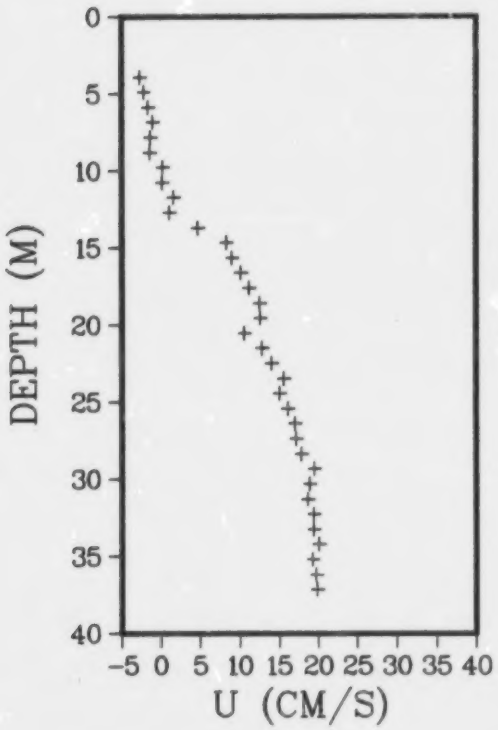


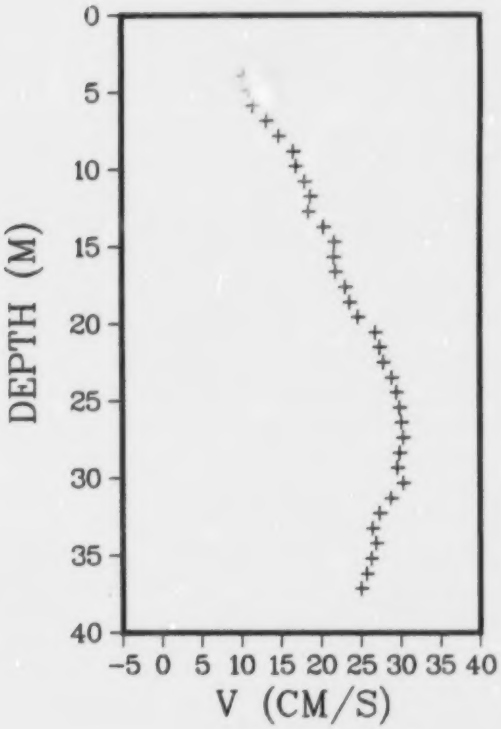


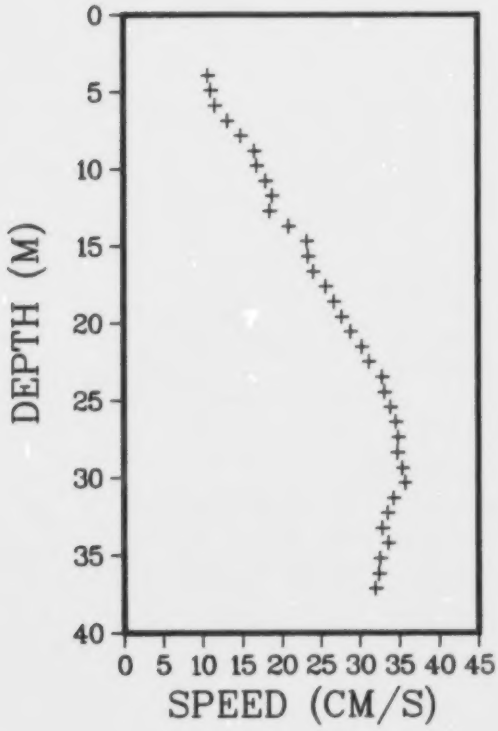


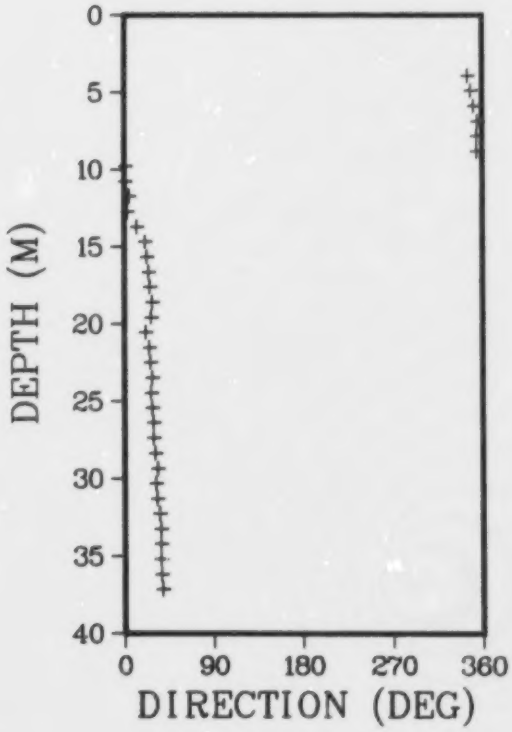
MARCH 21, LINE 2047-2300

87/03/21 15:47:35 UP CAST4

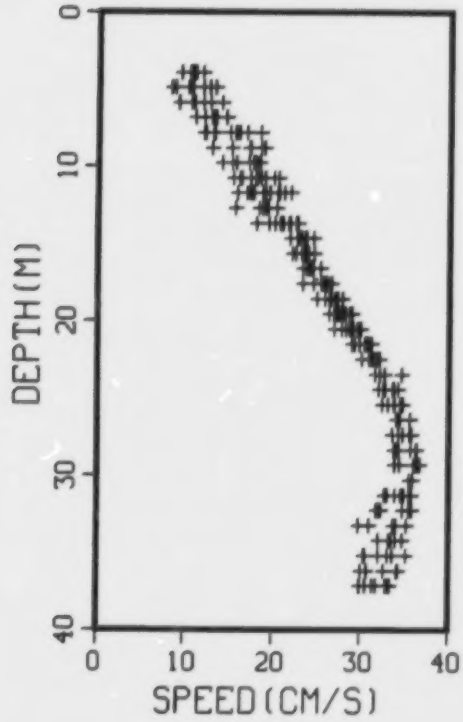


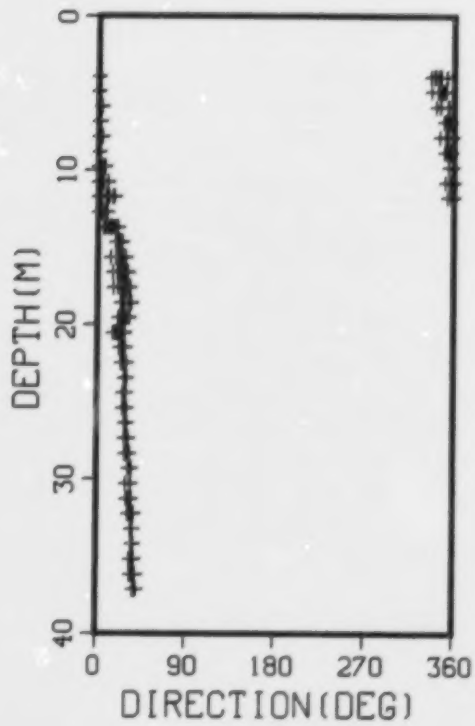


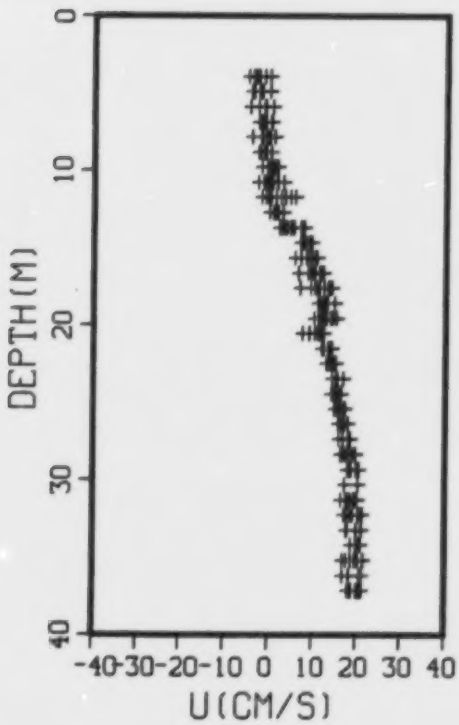


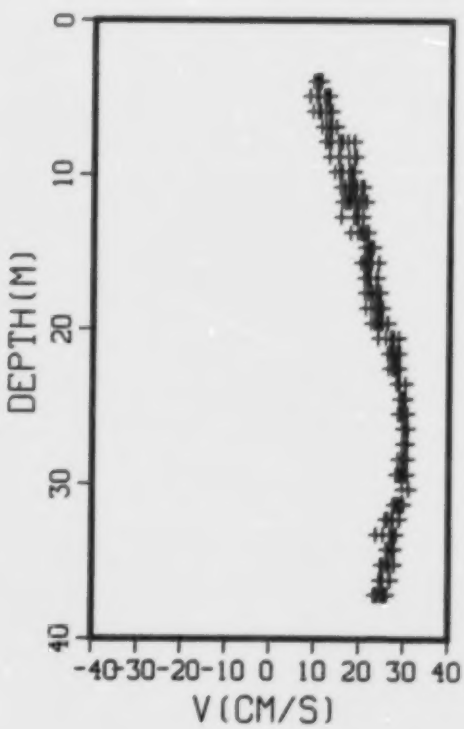


CAST 4 UP CONTINUOUS









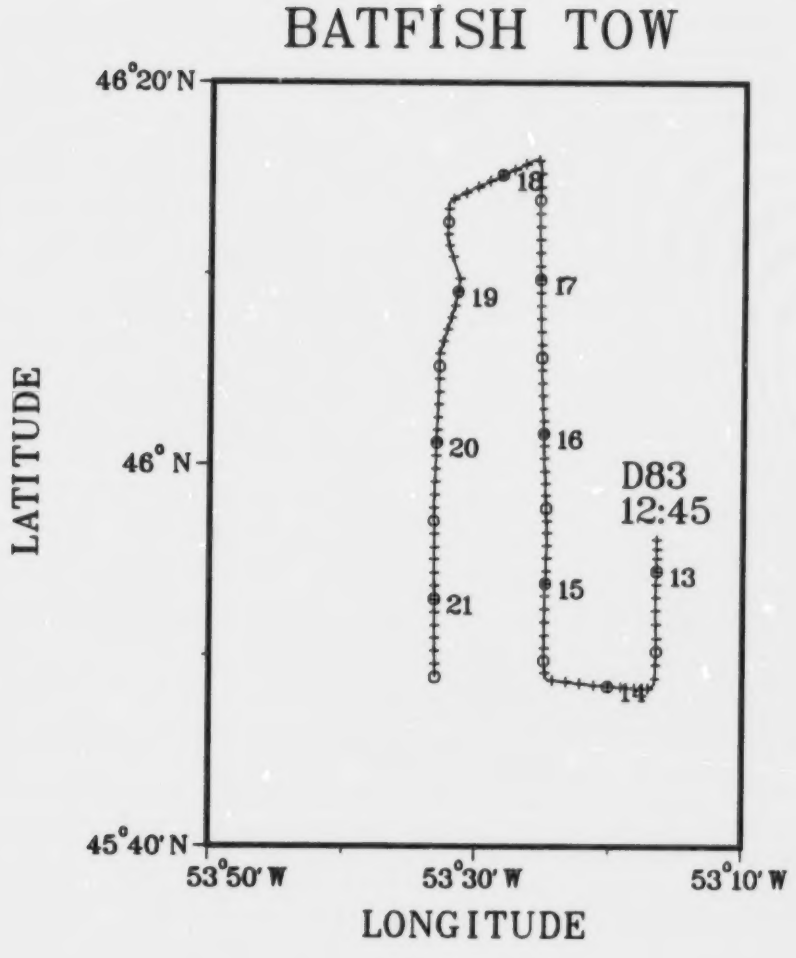
MARCH 21, LINE 2301-2592

9. Batfish data

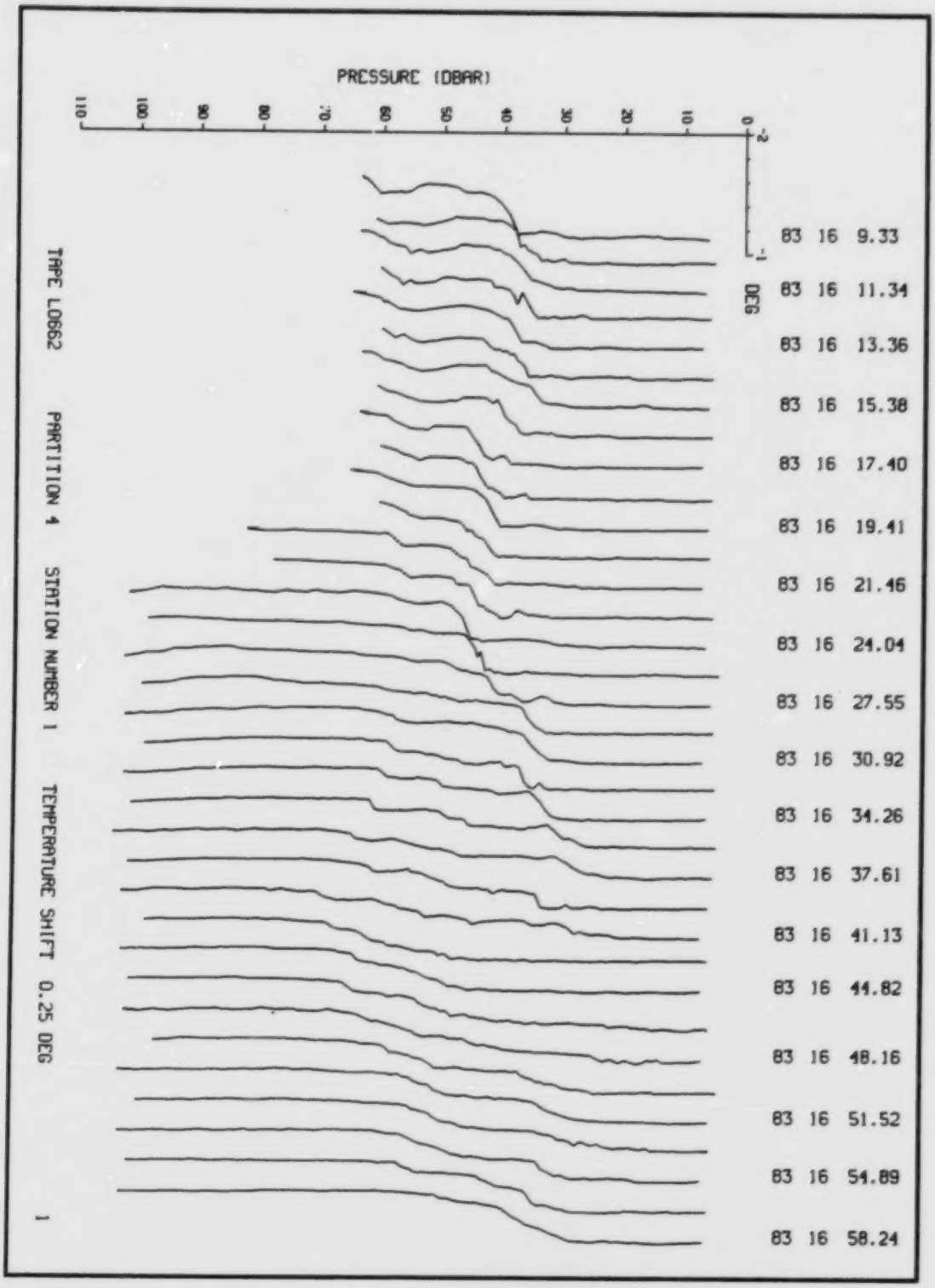
Hydrographic data of high horizontal resolution were obtained using a Batfish. The Batfish is a programmable towed body carrying a CTD probe. Tow speed ranges from 3 to 10 knots with a descending/ascending speed of approximately 1 ms^{-1}.

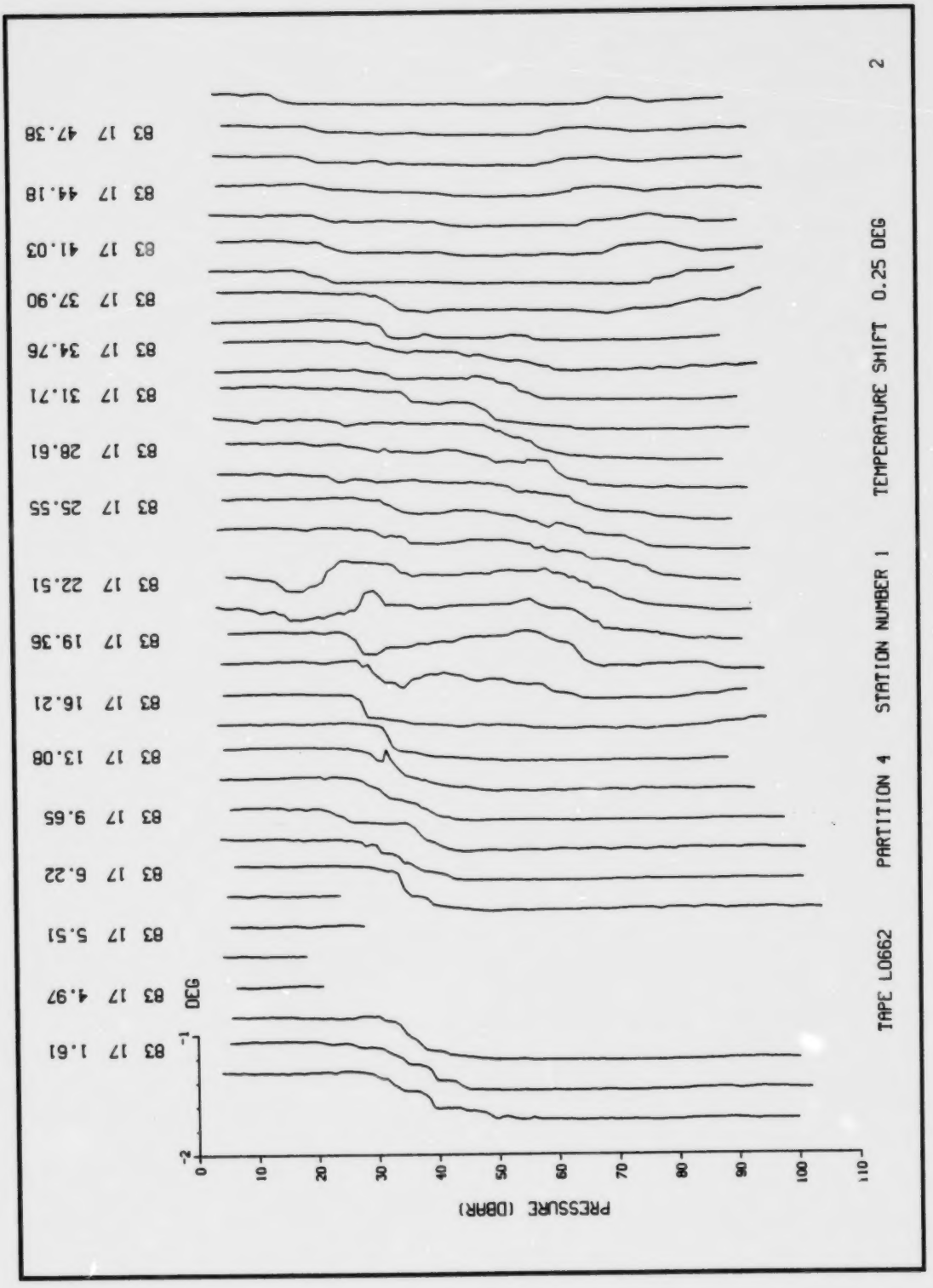
The Batfish measurement was conducted from 1245Z to 2130Z on March 24 (Julian day 83). Page 104 shows the ship track during the Batfish tow. Seven hours and 35 minutes' useful data were obtained. Multiple vertical traces of temperature, salinity and σ_t are presented in pp. 105 to 128. Times are displayed on the top of the traces. The three numbers denote Julian day, GMT hour and minute. The vertical axis is pressure in dbar. The horizontal axis at the upper left corner of each plot is valid for the first trace only. The subsequent traces are shifted to the right from the previous trace by an amount indicated at the bottom of the plots. The labels for the horizontal axis, "DEG", "PPT" and "SIG-T", stand for degree ^0C, parts per thousand and σ_t unit respectively.

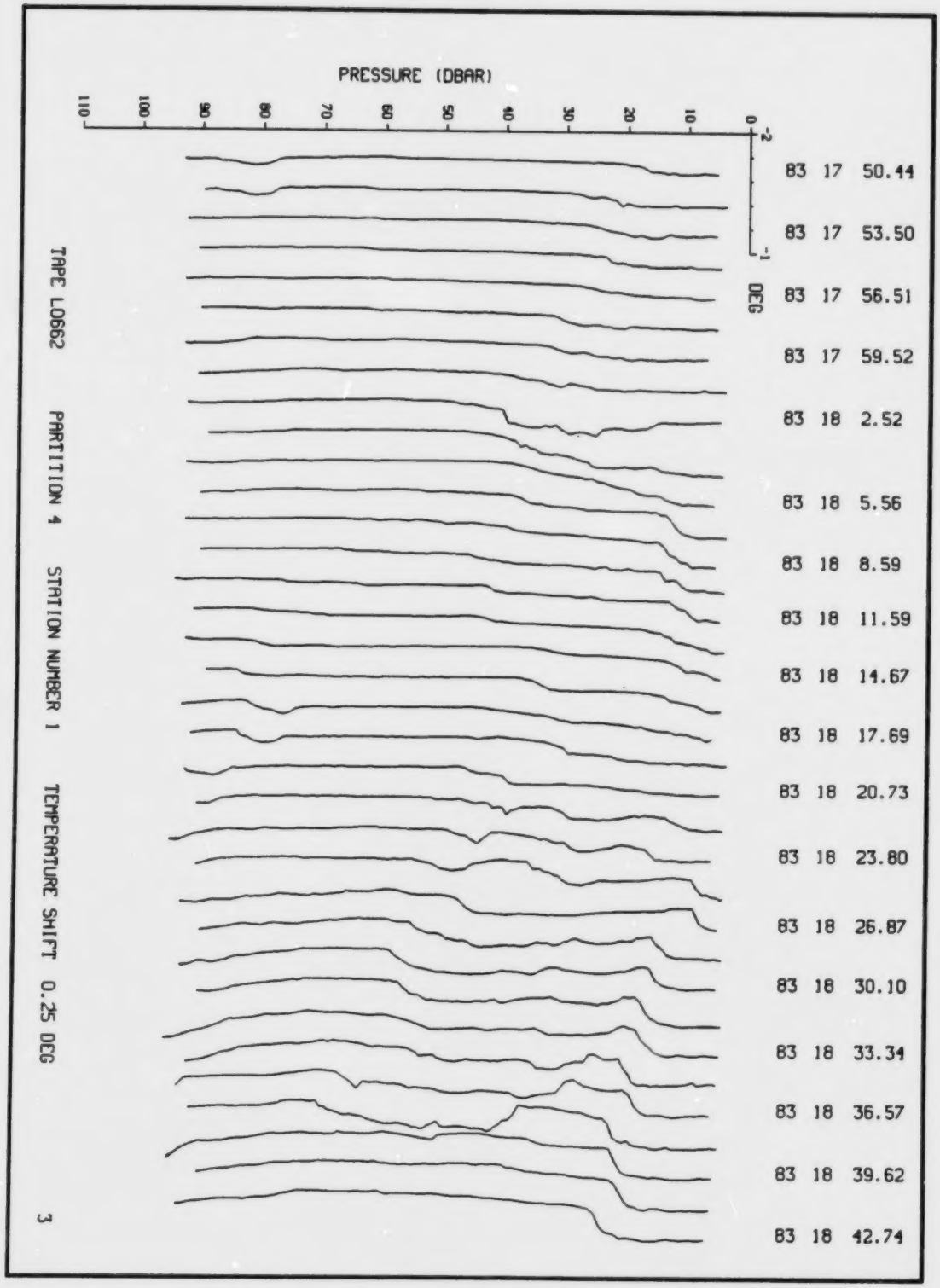
Vertical section plots for temperature, salinity and σ_t are shown in pp.129 to 149. Times are given on the top of the plots. Distance from the start position is indicated at the bottom. Crossings of given parameter values are marked along the track with different symbols. The parameter values represented by the symbols are given at the bottom of the pages.

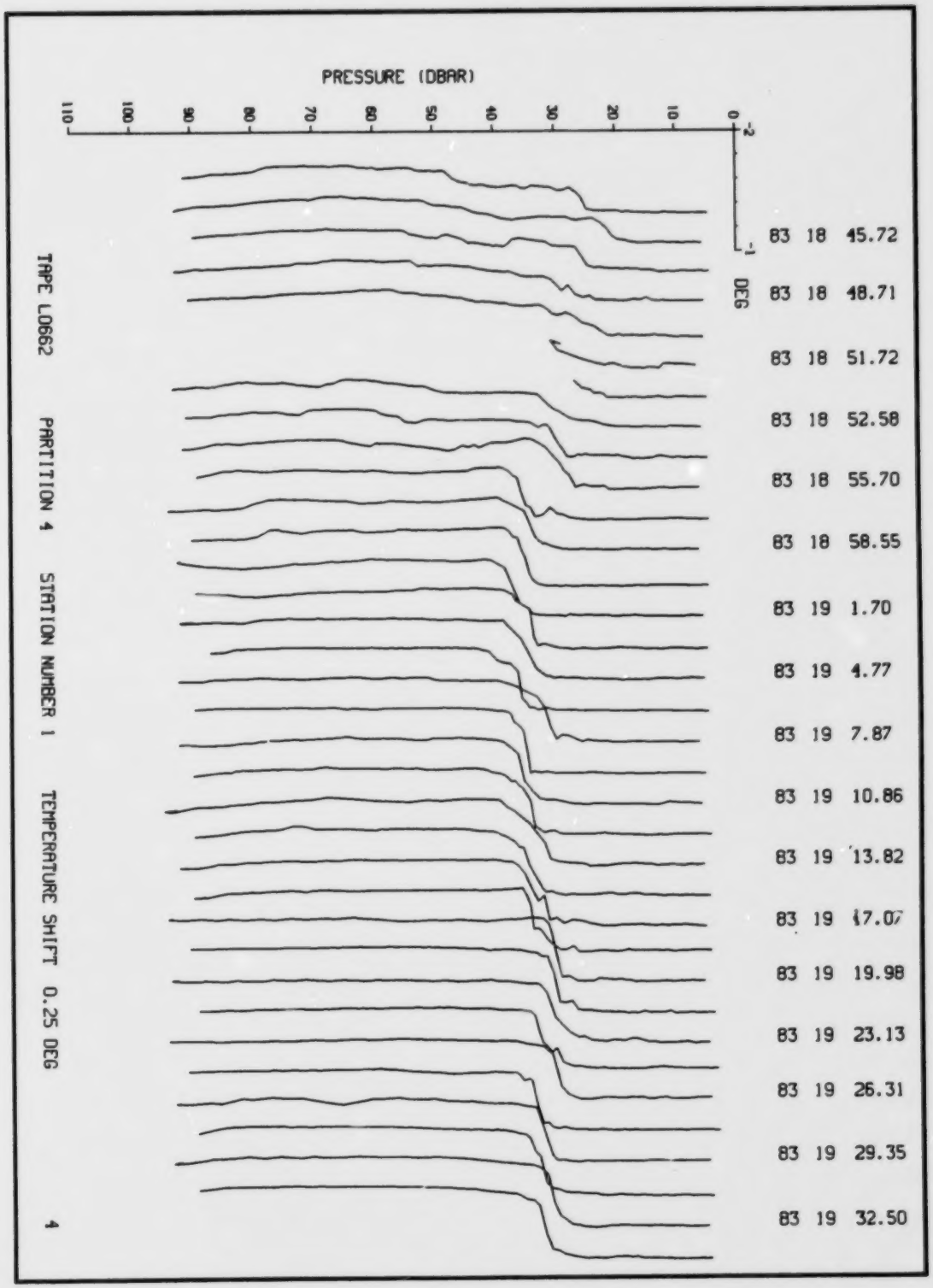

BATFISH TOW
46°20' N
46° N
45°40' N
LATITUDE
53°50' W
53°30' W
53°10' W
LONGITUDE
18
19
17
20
16
D83
12:45
13
15
21
14

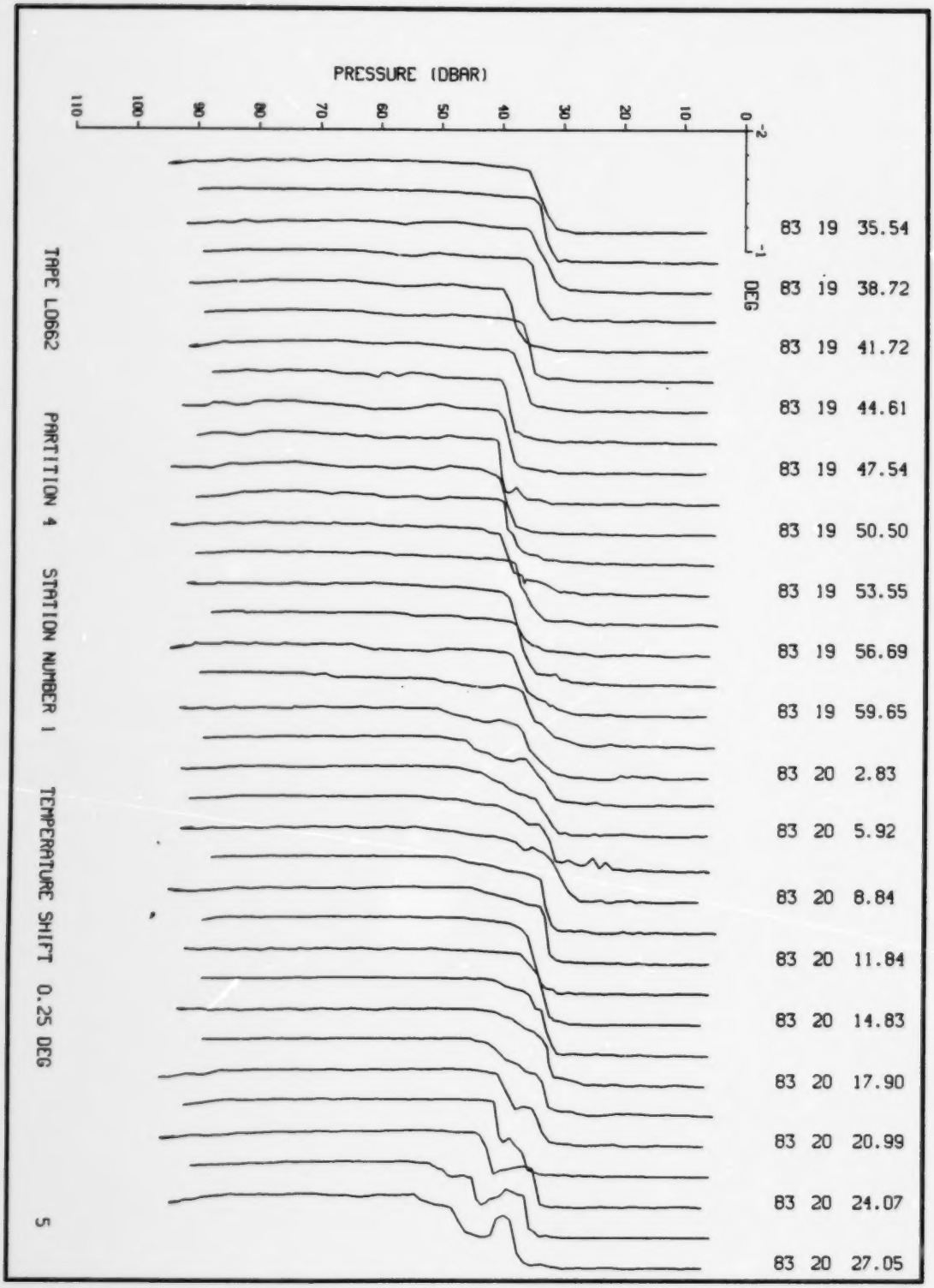
Batfish temperature profiles

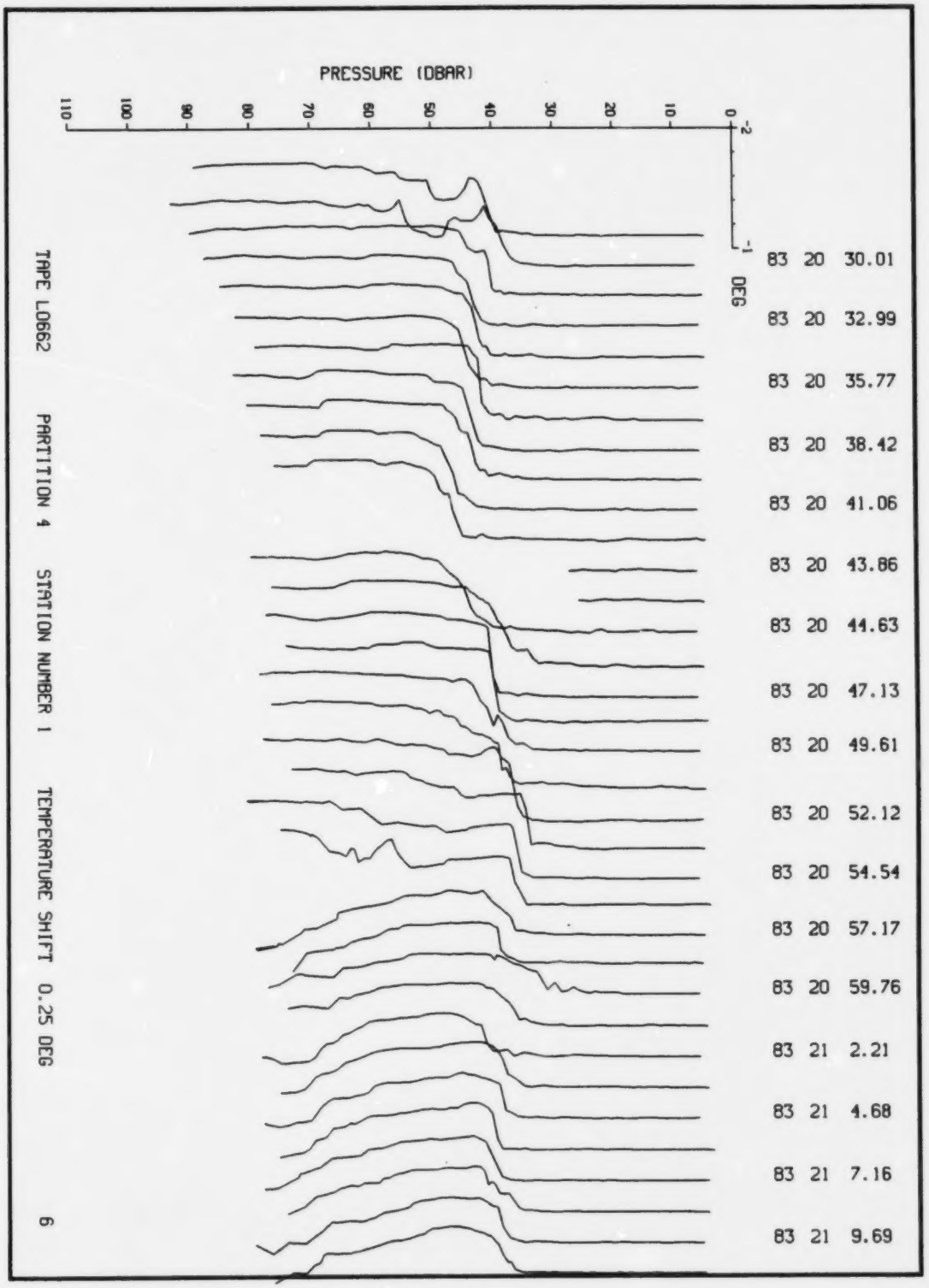

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
2
1
DEG
TAPE LO662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG
1
83 16 9.33
83 16 11.34
83 16 13.36
83 16 15.38
83 16 17.40
83 16 19.41
83 16 21.46
83 16 24.04
83 16 27.55
83 16 30.92
83 16 34.26
83 16 37.61
83 16 41.13
83 16 44.82
83 16 48.16
83 16 51.52
83 16 54.89
83 16 58.24

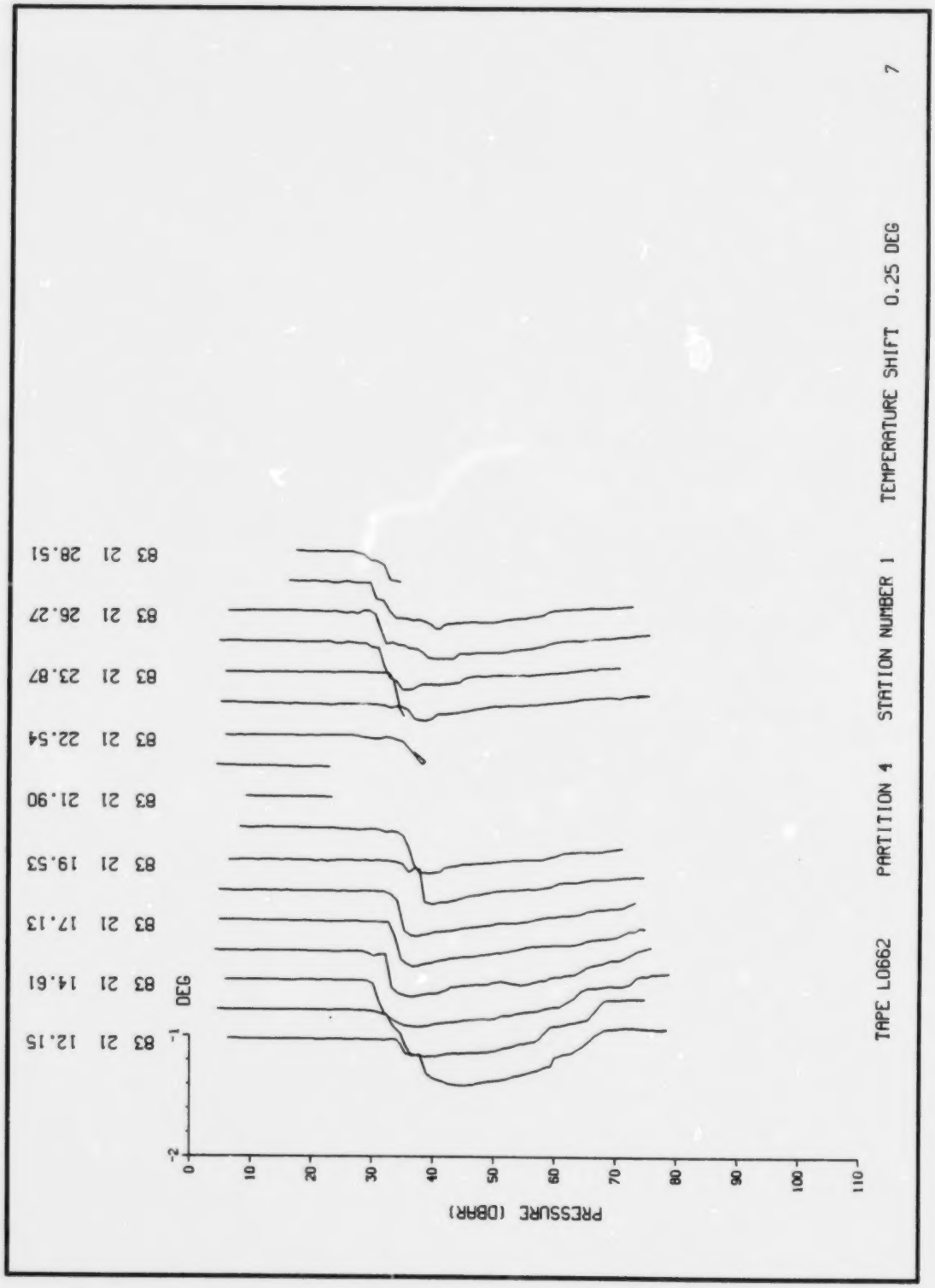

TAPE L0662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG
2
PRESSURE (DBAR)
DEG
-1
-2
0
10
20
30
40
50
60
70
80
90
100
110
83 17 1.61
83 17 4.97
83 17 5.51
83 17 6.22
83 17 9.65
83 17 13.08
83 17 16.21
83 17 19.36
83 17 22.51
83 17 25.55
83 17 28.61
83 17 31.71
83 17 34.76
83 17 37.90
83 17 41.03
83 17 44.18
83 17 47.38


PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
-2
-1
DEG
83 17 50.44
83 17 53.50
83 17 56.51
83 17 59.52
83 18 2.52
83 18 5.56
83 18 8.59
83 18 11.59
83 18 14.67
83 18 17.69
83 18 20.73
83 18 23.80
83 18 26.87
83 18 30.10
83 18 33.34
83 18 36.57
83 18 39.62
83 18 42.74
TAPE L0662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG
3

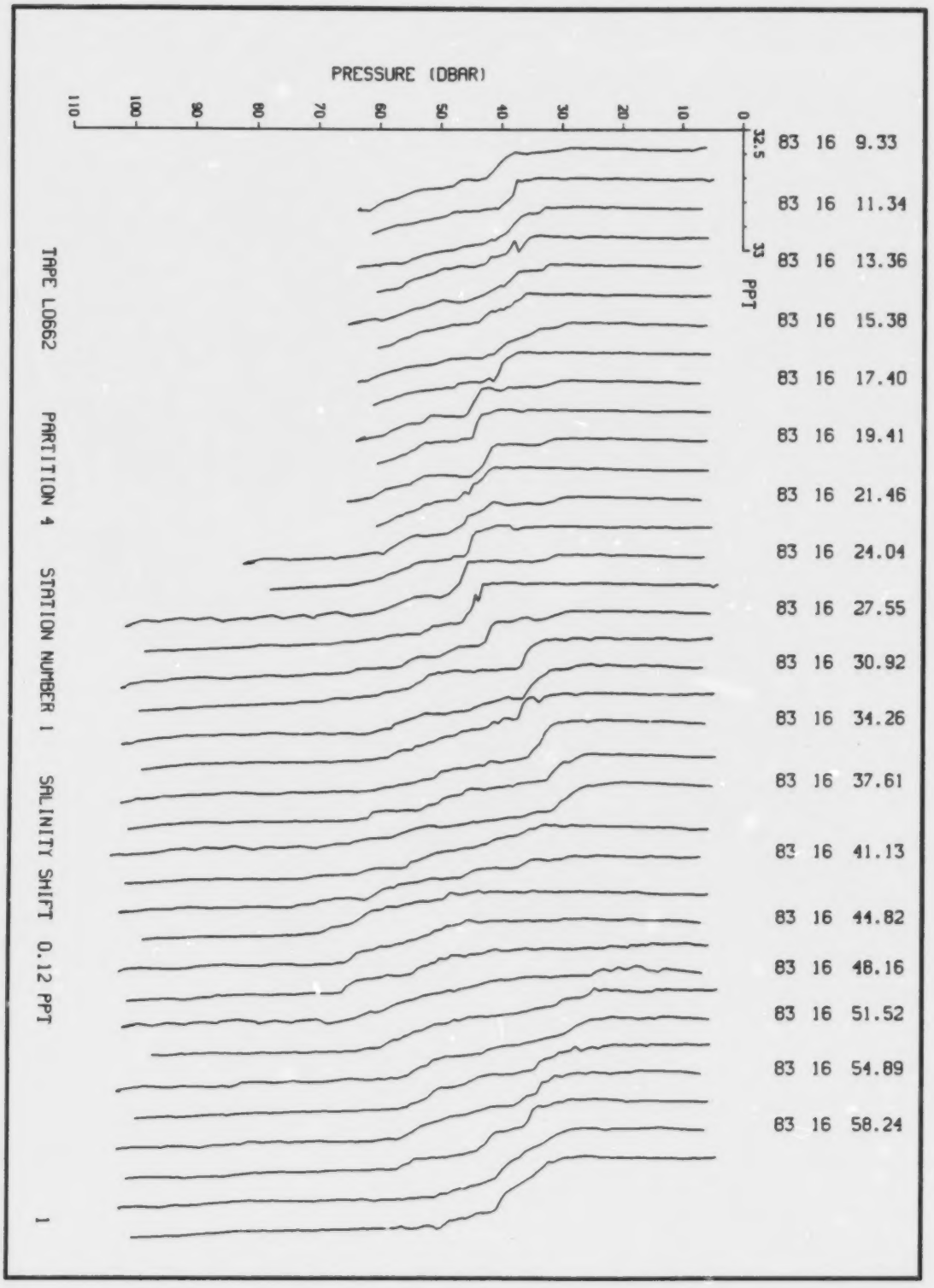

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
2
1
DEG
TAPE L0662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG
4
83 18 45.72
83 18 48.71
83 18 51.72
83 18 52.58
83 18 55.70
83 18 58.55
83 19 1.70
83 19 4.77
83 19 7.87
83 19 10.86
83 19 13.82
83 19 17.07
83 19 19.98
83 19 23.13
83 19 26.31
83 19 29.35
83 19 32.50

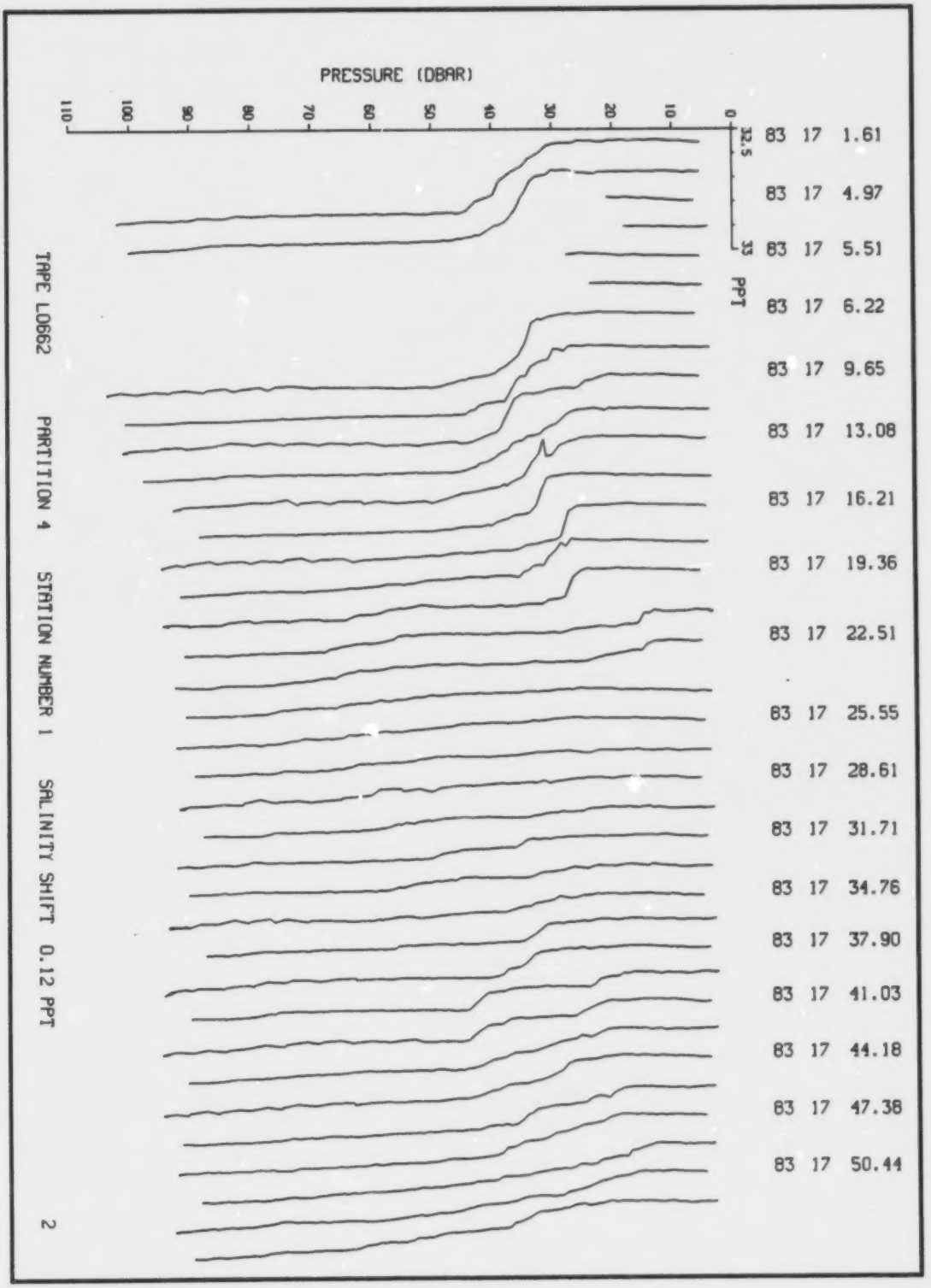

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
-2
-1
DEG
TAPE L0662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG
5
83 19 35.54
83 19 38.72
83 19 41.72
83 19 44.61
83 19 47.54
83 19 50.50
83 19 53.55
83 19 56.69
83 19 59.65
83 20 2.83
83 20 5.92
83 20 8.84
83 20 11.84
83 20 14.83
83 20 17.90
83 20 20.99
83 20 24.07
83 20 27.05

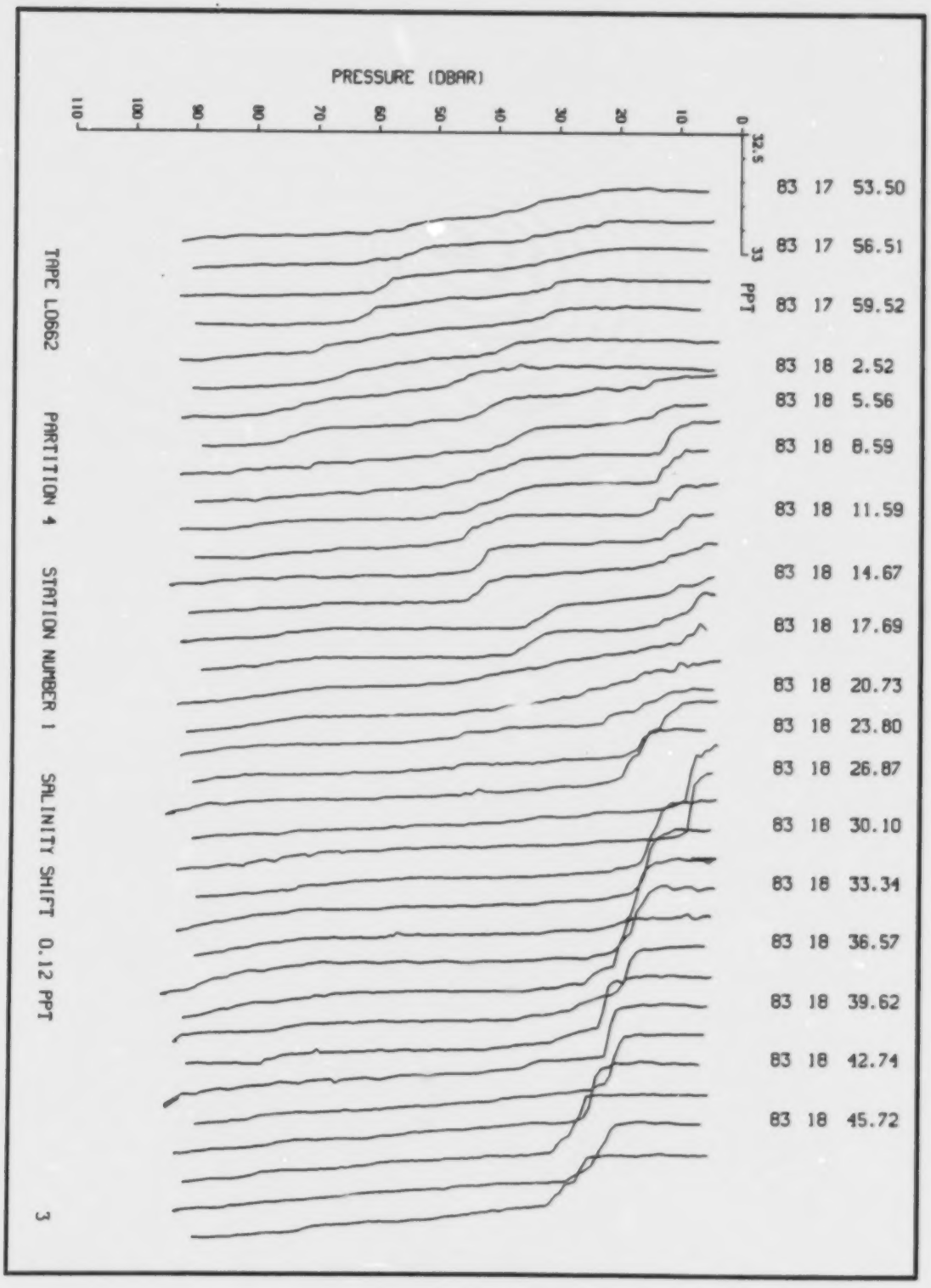

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
-2
-1
DEG
TAPE L0662
PARTITION 4
STATION NUMBER 1
TEMPERATURE SHIFT 0.25 DEG
6
83 20 30.01
83 20 32.99
83 20 35.77
83 20 38.42
83 20 41.06
83 20 43.86
83 20 44.63
83 20 47.13
83 20 49.61
83 20 52.12
83 20 54.54
83 20 57.17
83 20 59.76
83 21 2.21
83 21 4.68
83 21 7.16
83 21 9.69

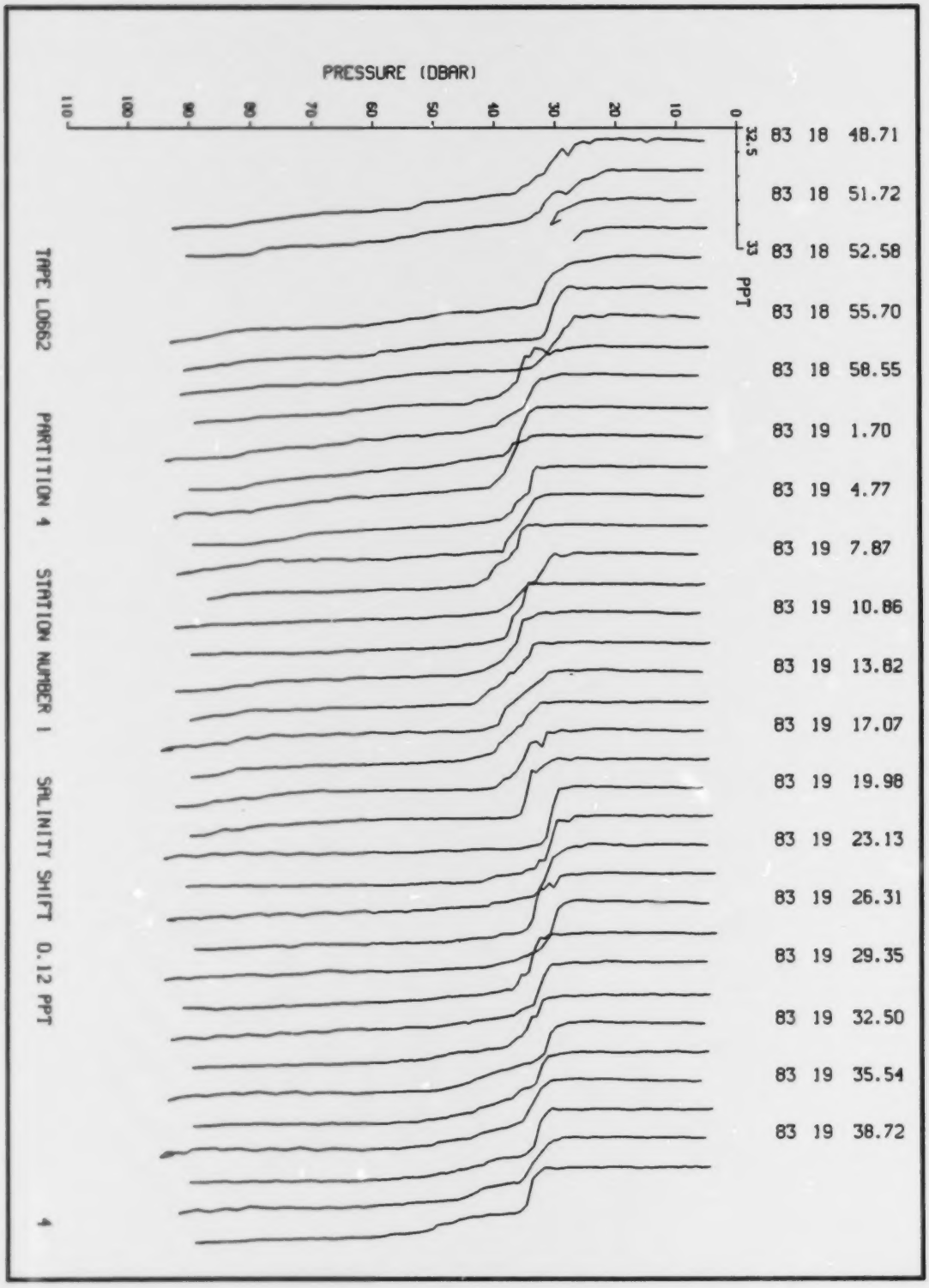

TAPE L0662 PARTITION 4 STATION NUMBER 1 TEMPERATURE SHIFT 0.25 DEG 7
PRESSURE (DBAR)
DEG
83 21 12.15
83 21 14.61
83 21 17.13
83 21 19.53
83 21 21.90
83 21 22.54
83 21 23.87
83 21 26.27
83 21 28.51

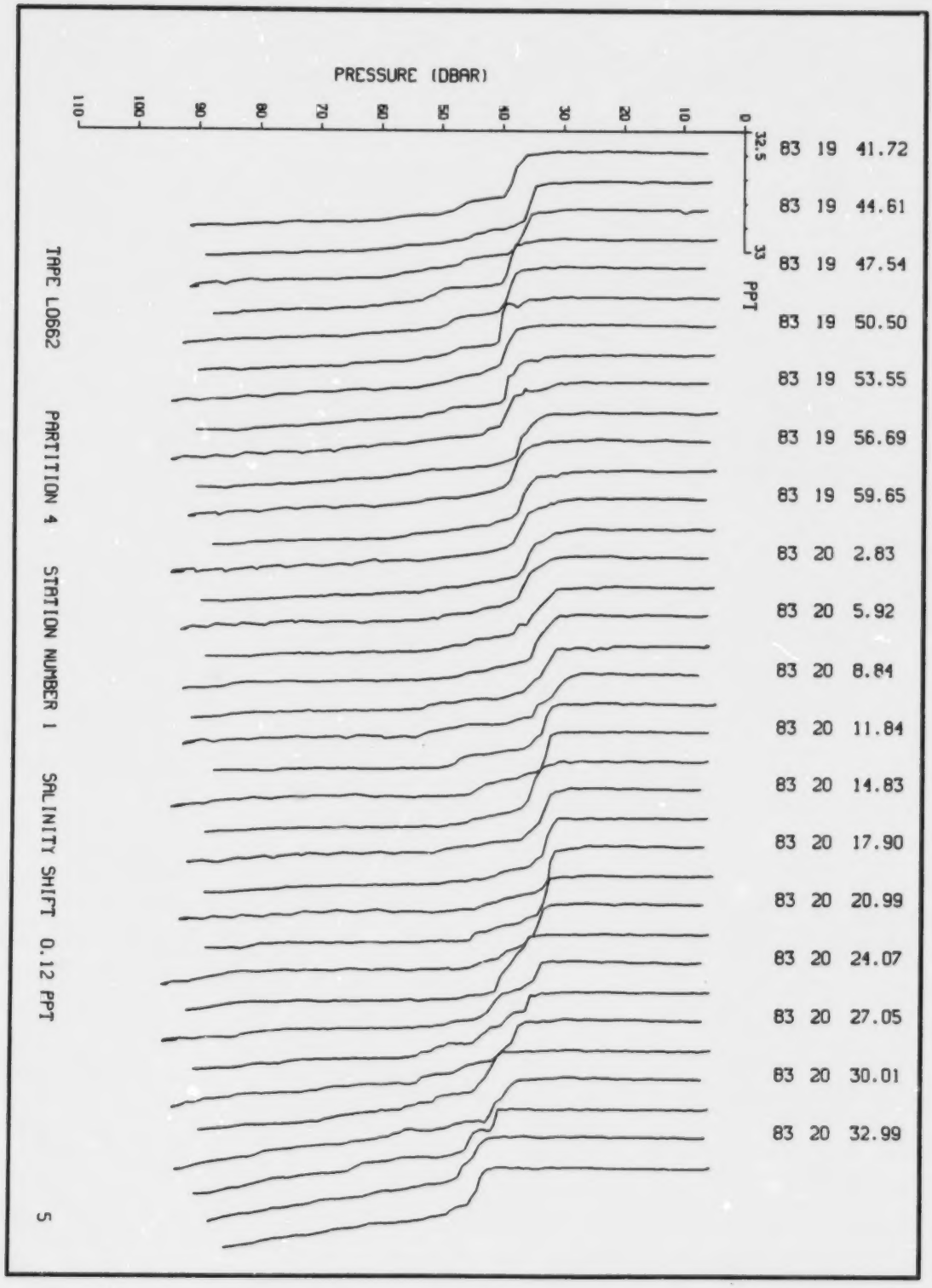
Batfish salinity profiles

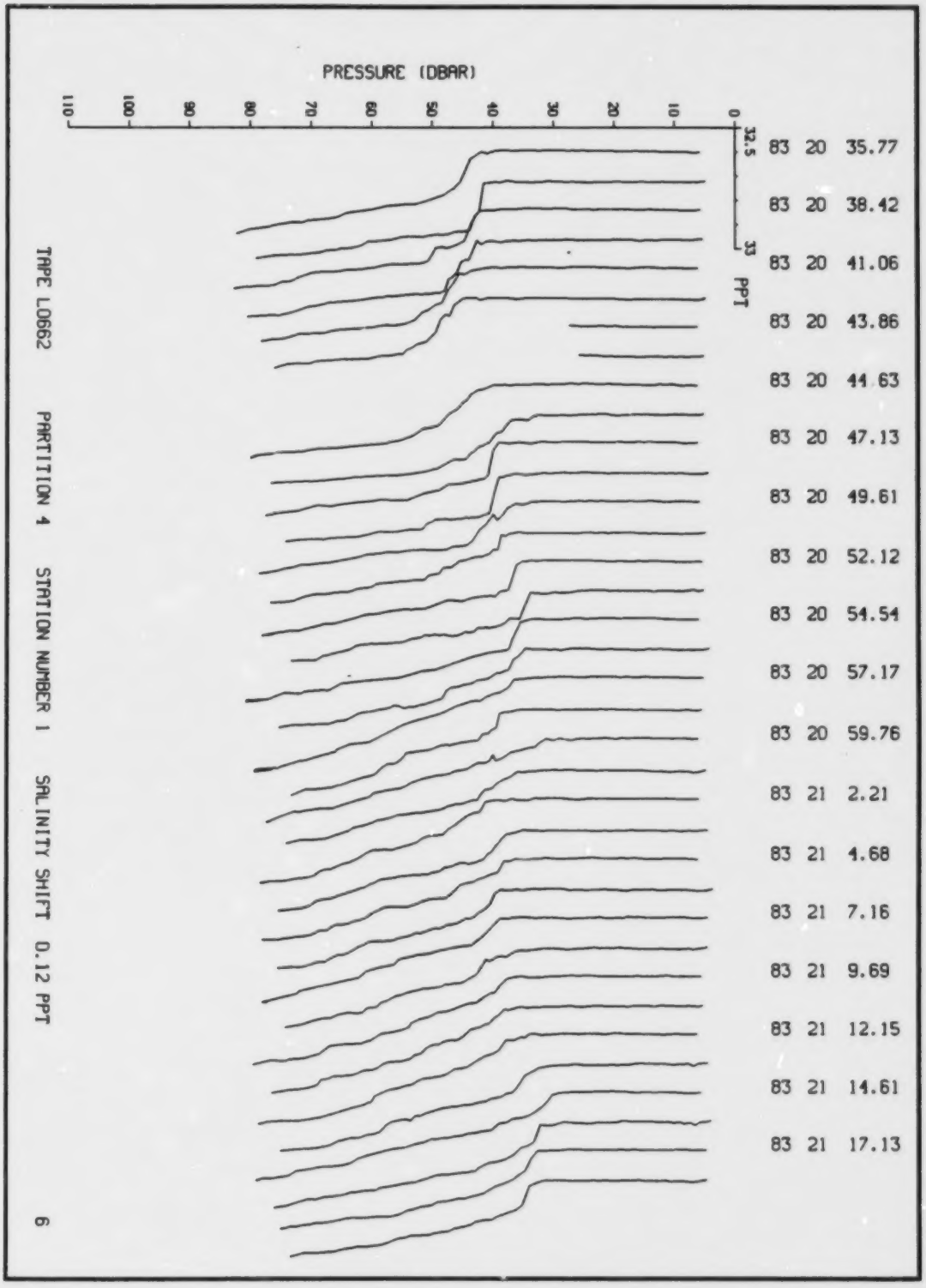

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 16 9.33
83 16 11.34
83 16 13.36
83 16 15.38
83 16 17.40
83 16 19.41
83 16 21.46
83 16 24.04
83 16 27.55
83 16 30.92
83 16 34.26
83 16 37.61
83 16 41.13
83 16 44.82
83 16 48.16
83 16 51.52
83 16 54.89
83 16 58.24
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
1

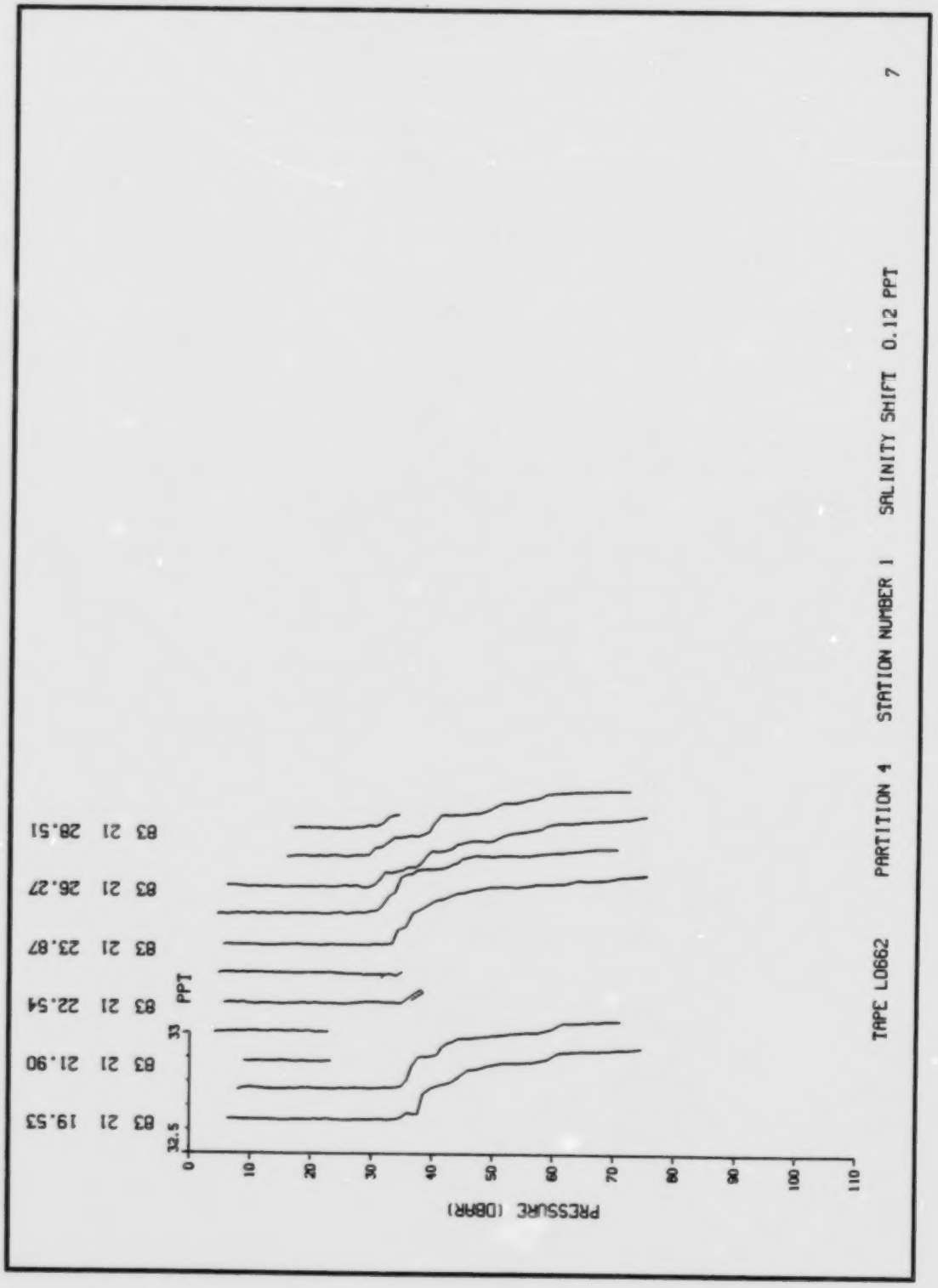

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 17 1.61
83 17 4.97
83 17 5.51
83 17 6.22
83 17 9.65
83 17 13.08
83 17 16.21
83 17 19.36
83 17 22.51
83 17 25.55
83 17 28.61
83 17 31.71
83 17 34.76
83 17 37.90
83 17 41.03
83 17 44.18
83 17 47.38
83 17 50.44
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
2


PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 17 53.50
83 17 56.51
83 17 59.52
83 18 2.52
83 18 5.56
83 18 8.59
83 18 11.59
83 18 14.67
83 18 17.69
83 18 20.73
83 18 23.80
83 18 26.87
83 18 30.10
83 18 33.34
83 18 36.57
83 18 39.62
83 18 42.74
83 18 45.72
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
3

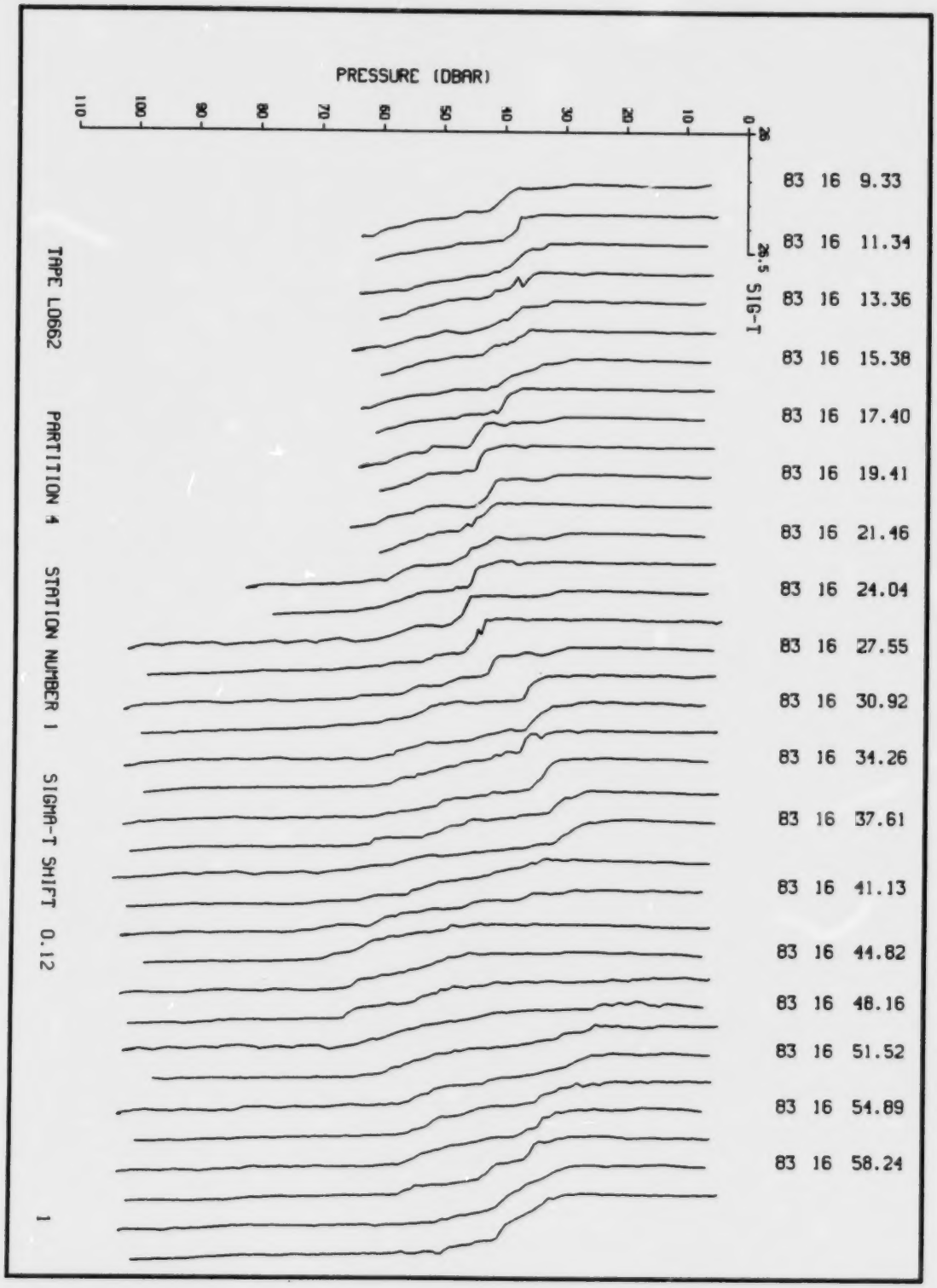

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 18 48.71
83 18 51.72
83 18 52.58
83 18 55.70
83 18 58.55
83 19 1.70
83 19 4.77
83 19 7.87
83 19 10.86
83 19 13.82
83 19 17.07
83 19 19.98
83 19 23.13
83 19 26.31
83 19 29.35
83 19 32.50
83 19 35.54
83 19 38.72
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
4

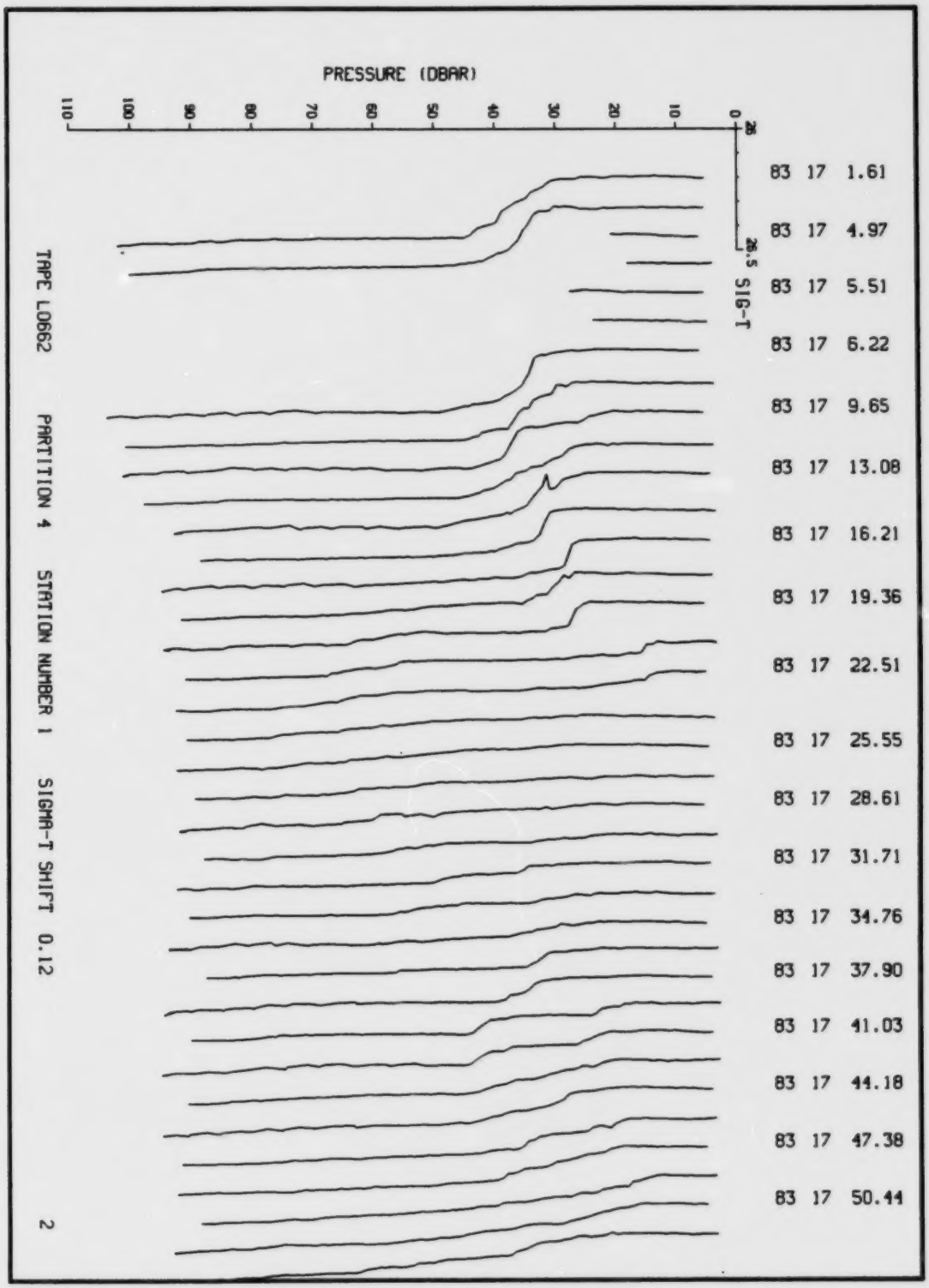

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 19 41.72
83 19 44.61
83 19 47.54
83 19 50.50
83 19 53.55
83 19 56.69
83 19 59.65
83 20 2.83
83 20 5.92
83 20 8.84
83 20 11.84
83 20 14.83
83 20 17.90
83 20 20.99
83 20 24.07
83 20 27.05
83 20 30.01
83 20 32.99
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
5

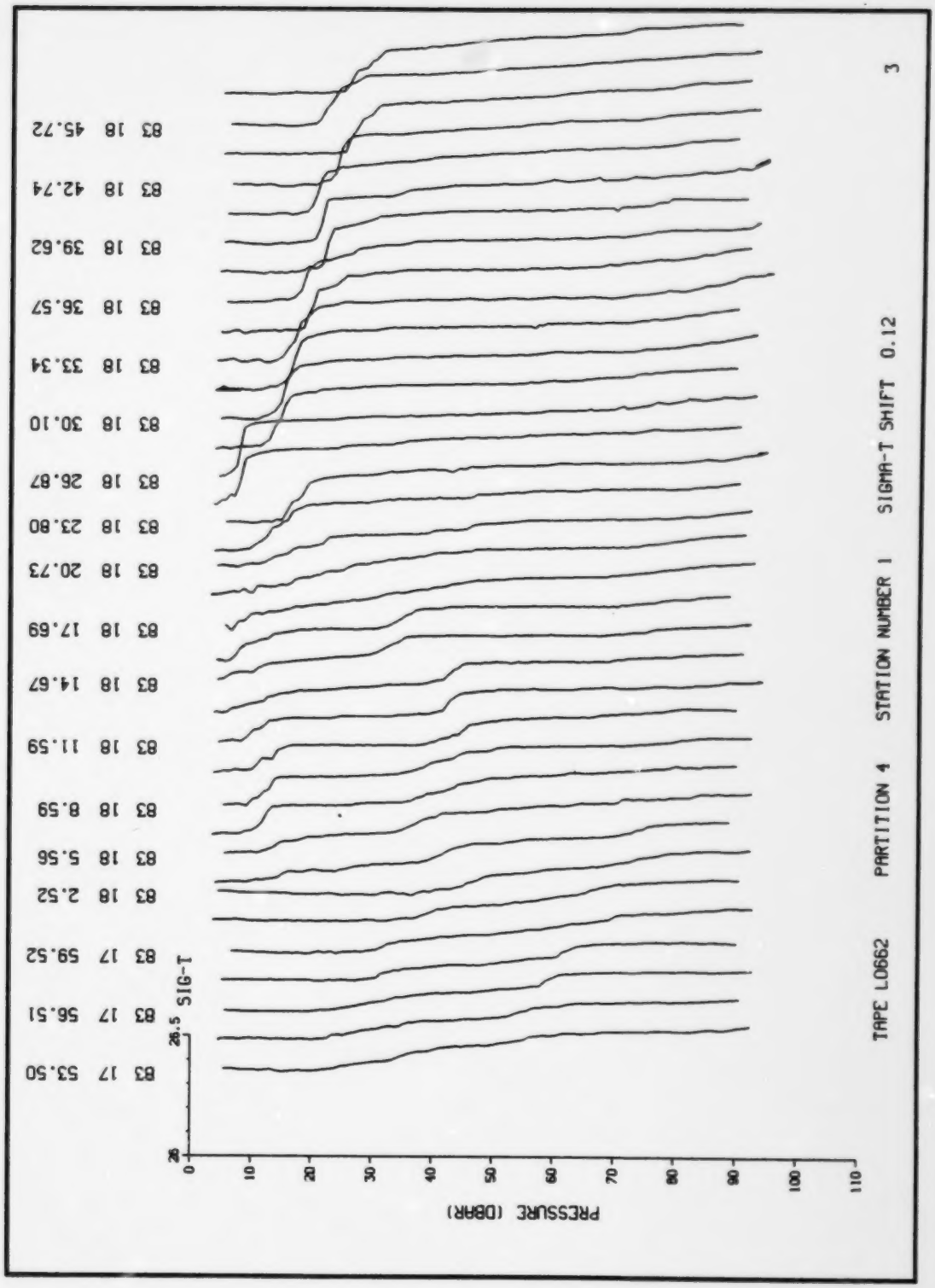

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
32.5
33
PPT
83 20 35.77
83 20 38.42
83 20 41.06
83 20 43.86
83 20 44.63
83 20 47.13
83 20 49.61
83 20 52.12
83 20 54.54
83 20 57.17
83 20 59.76
83 21 2.21
83 21 4.68
83 21 7.16
83 21 9.69
83 21 12.15
83 21 14.61
83 21 17.13
TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT
6

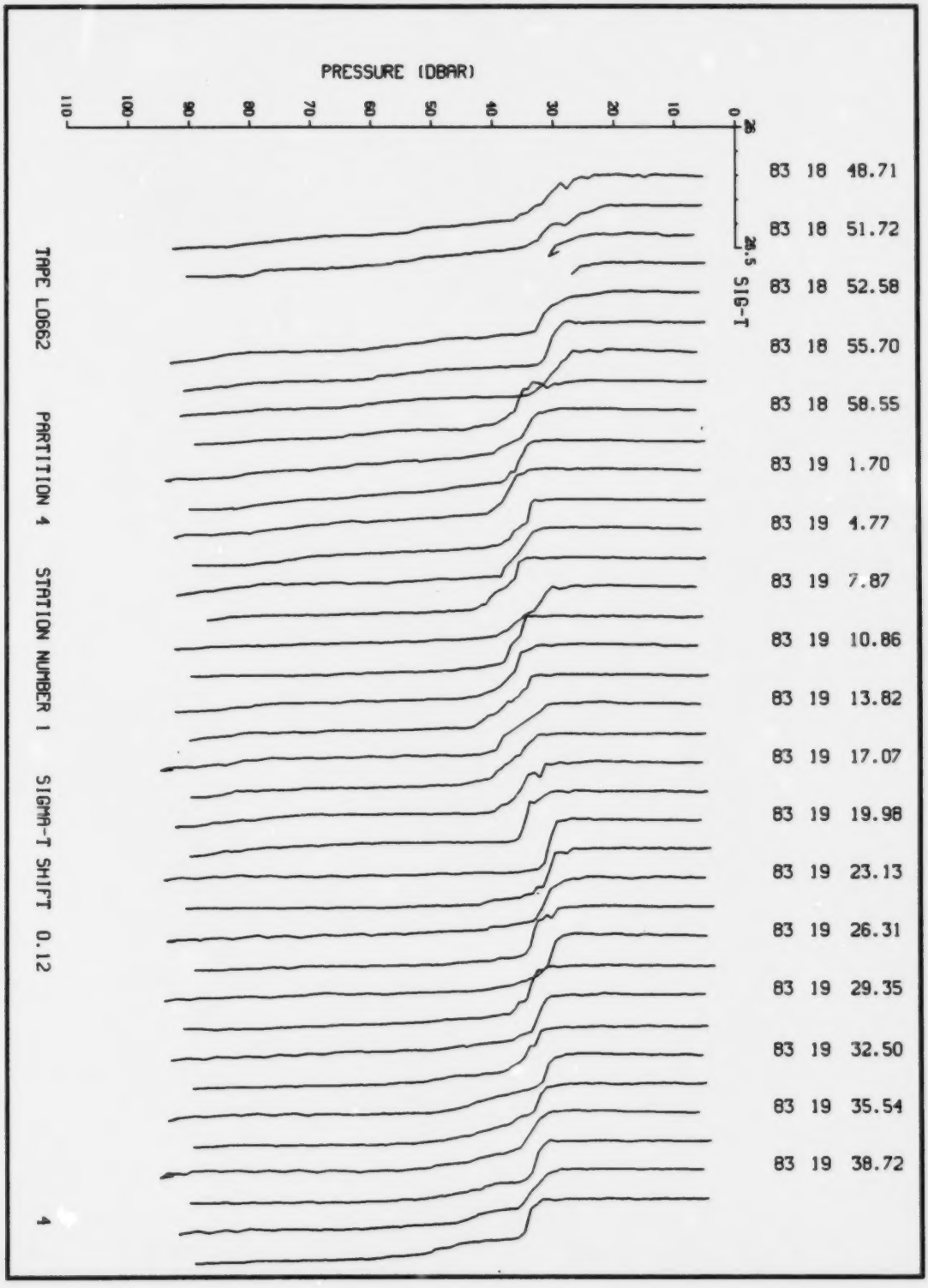

TAPE L0662 PARTITION 4 STATION NUMBER 1 SALINITY SHIFT 0.12 PPT 7
PRESSURE (DBAR)
0 10 20 30 40 50 60 70 80 90 100 110
33
32.5
PPT
83 21 19.53
83 21 21.90
83 21 22.54
83 21 23.87
83 21 26.27
83 21 28.51

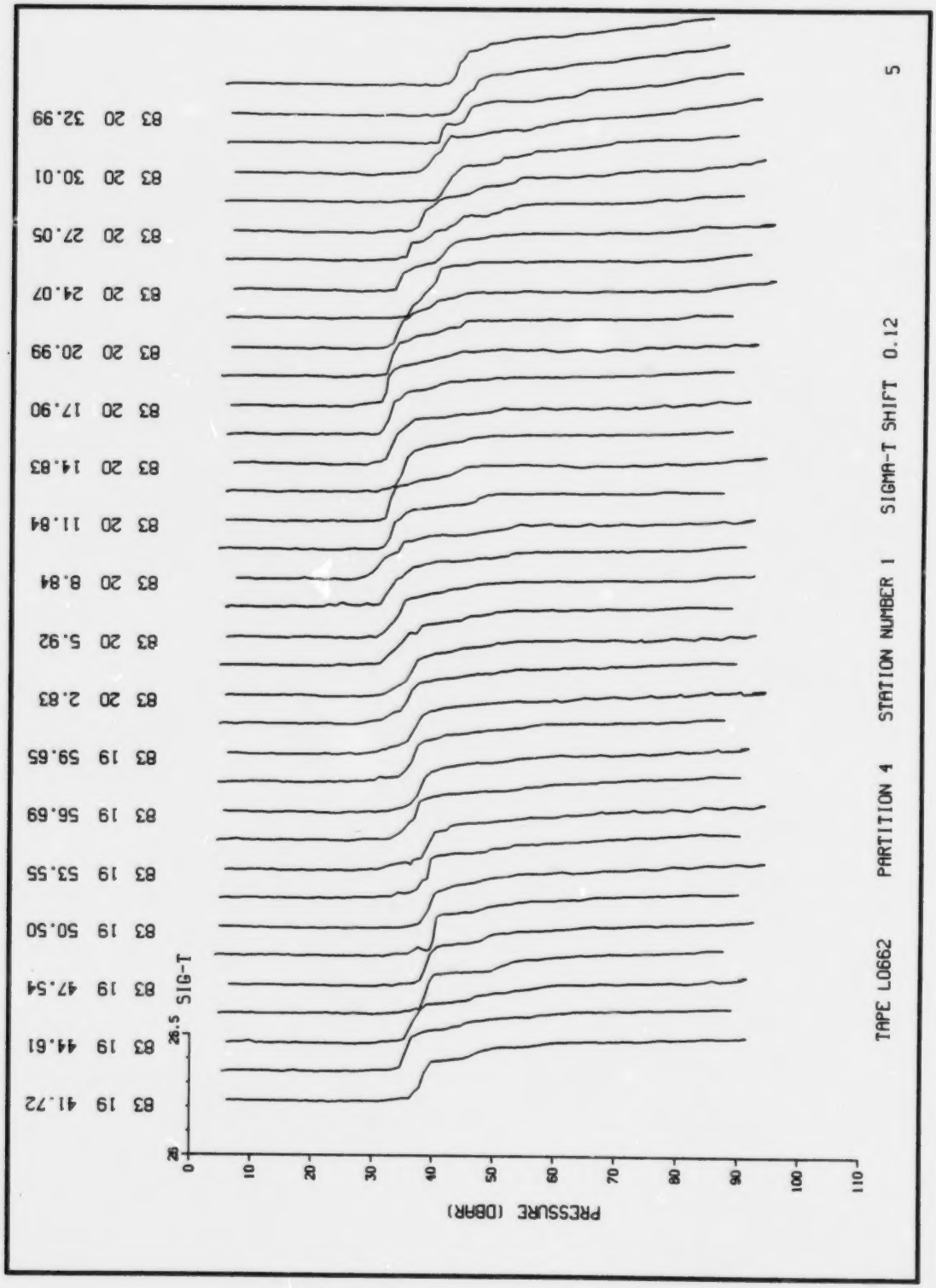
Batfish σ_t profiles


PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
28
26.5
SIG-T
83 16 9.33
83 16 11.34
83 16 13.36
83 16 15.38
83 16 17.40
83 16 19.41
83 16 21.46
83 16 24.04
83 16 27.55
83 16 30.92
83 16 34.26
83 16 37.61
83 16 41.13
83 16 44.82
83 16 48.16
83 16 51.52
83 16 54.89
83 16 58.24
TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
1


PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
28
26.5
SIG-T
83 17 1.61
83 17 4.97
83 17 5.51
83 17 6.22
83 17 9.65
83 17 13.08
83 17 16.21
83 17 19.36
83 17 22.51
83 17 25.55
83 17 28.61
83 17 31.71
83 17 34.76
83 17 37.90
83 17 41.03
83 17 44.18
83 17 47.38
83 17 50.44
TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
2


TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
3
PRESSURE (DBAR)
SIG-T
26
26.5
0
10
20
30
40
50
60
70
80
90
100
110
83 17 53.50
83 17 56.51
83 17 59.52
83 18 2.52
83 18 5.56
83 18 8.59
83 18 11.59
83 18 14.67
83 18 17.69
83 18 20.73
83 18 23.80
83 18 26.87
83 18 30.10
83 18 33.34
83 18 36.57
83 18 39.62
83 18 42.74
83 18 45.72


PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
26
26.5
SIG-T
TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
4
83 18 48.71
83 18 51.72
83 18 52.58
83 18 55.70
83 18 58.55
83 19 1.70
83 19 4.77
83 19 7.87
83 19 10.86
83 19 13.82
83 19 17.07
83 19 19.98
83 19 23.13
83 19 26.31
83 19 29.35
83 19 32.50
83 19 35.54
83 19 38.72


TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
5
PRESSURE (DBAR)
0
10
20
30
40
50
60
70
80
90
100
110
SIG-T
26.5
25
83 19 41.72
83 19 44.61
83 19 47.54
83 19 50.50
83 19 53.55
83 19 56.69
83 19 59.65
83 20 2.83
83 20 5.92
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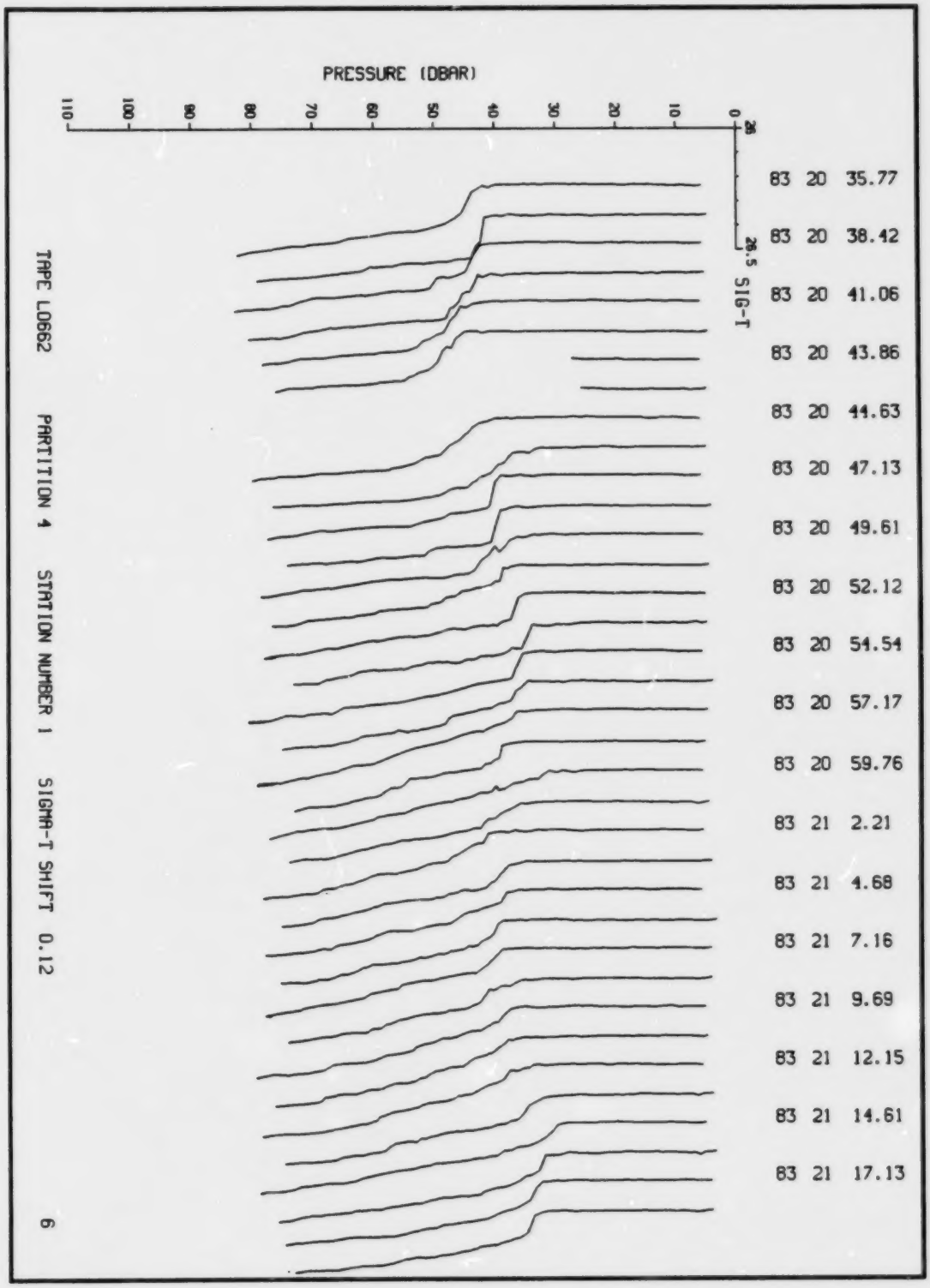
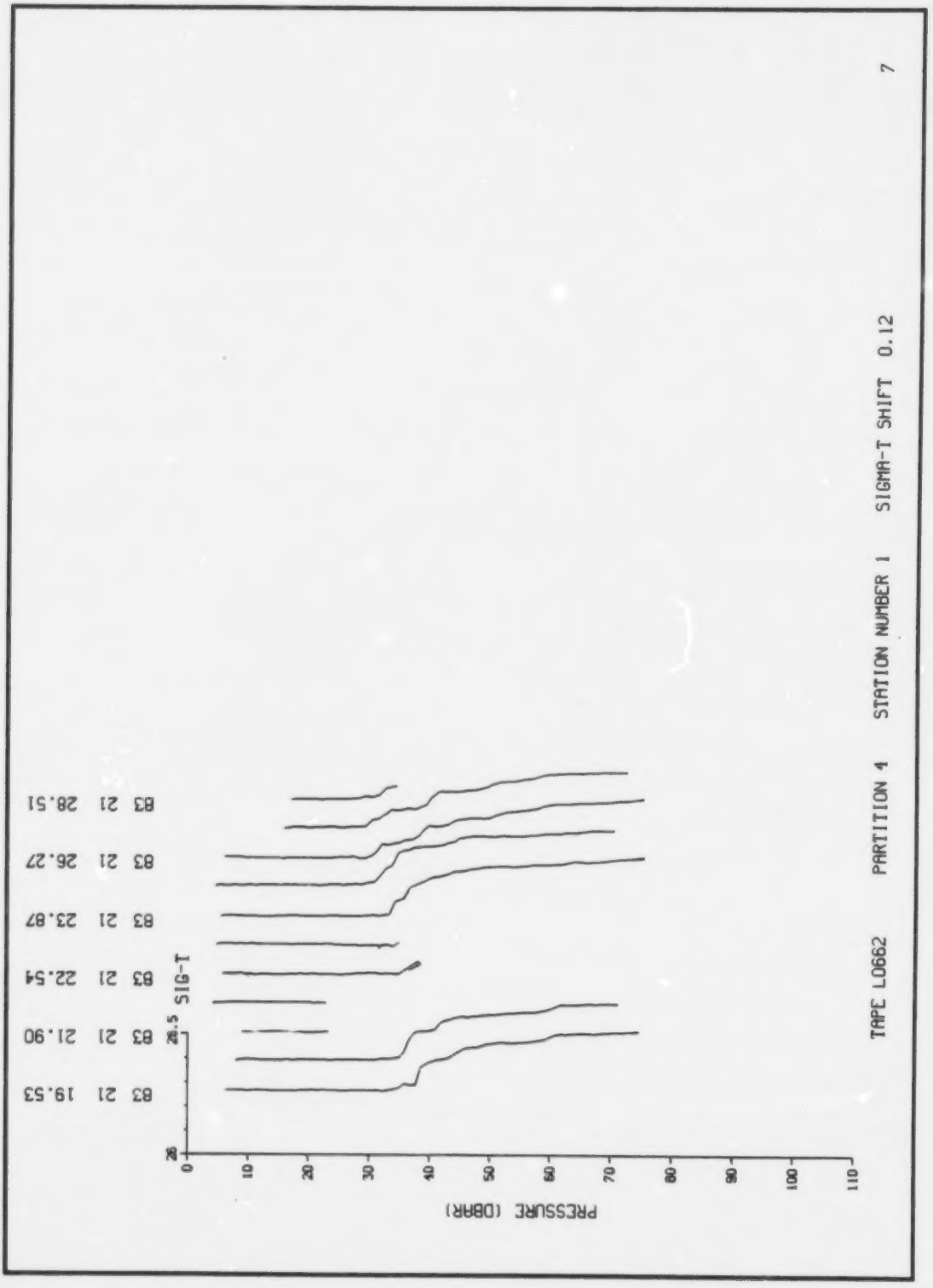
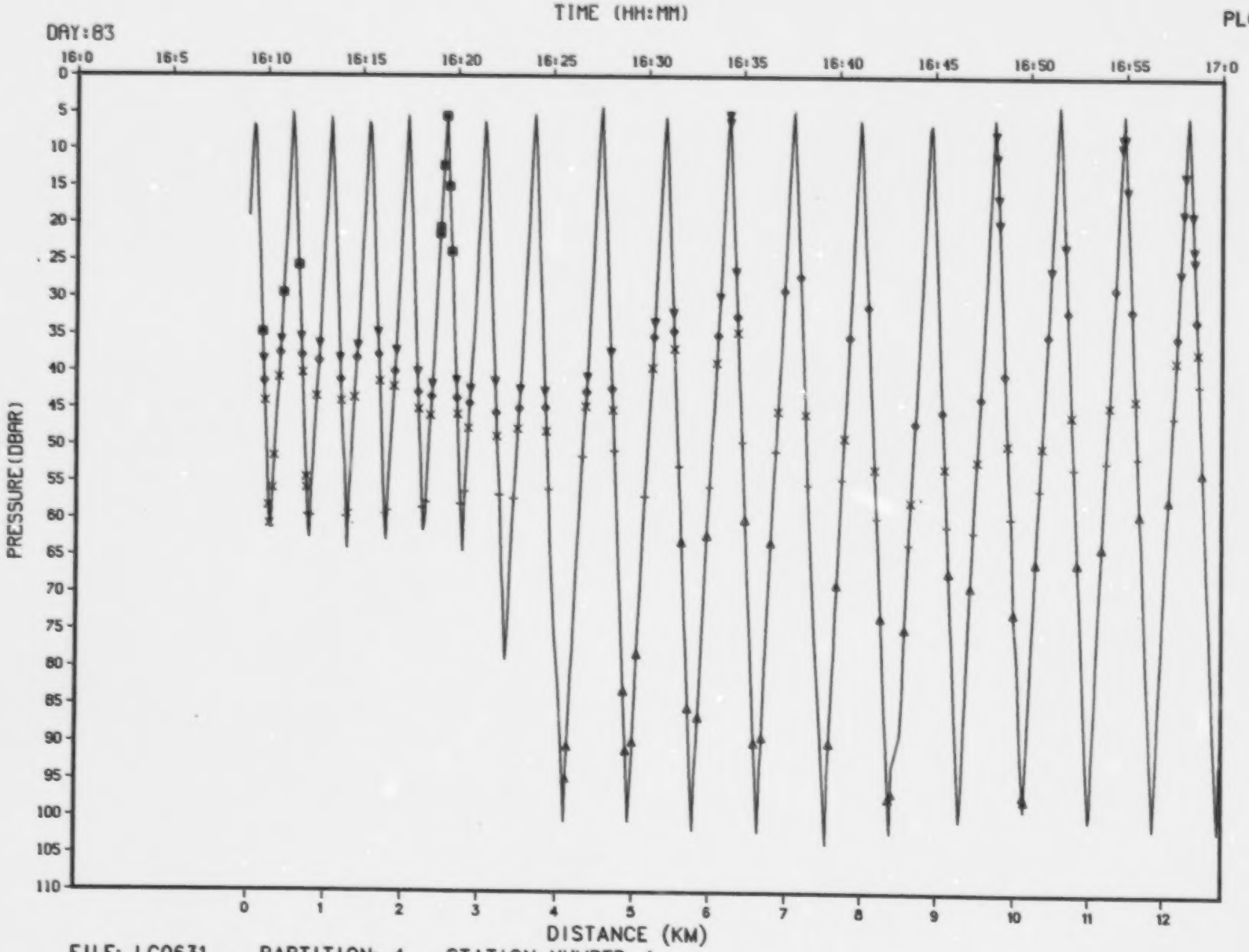
83 20 30.01
83 20 32.99

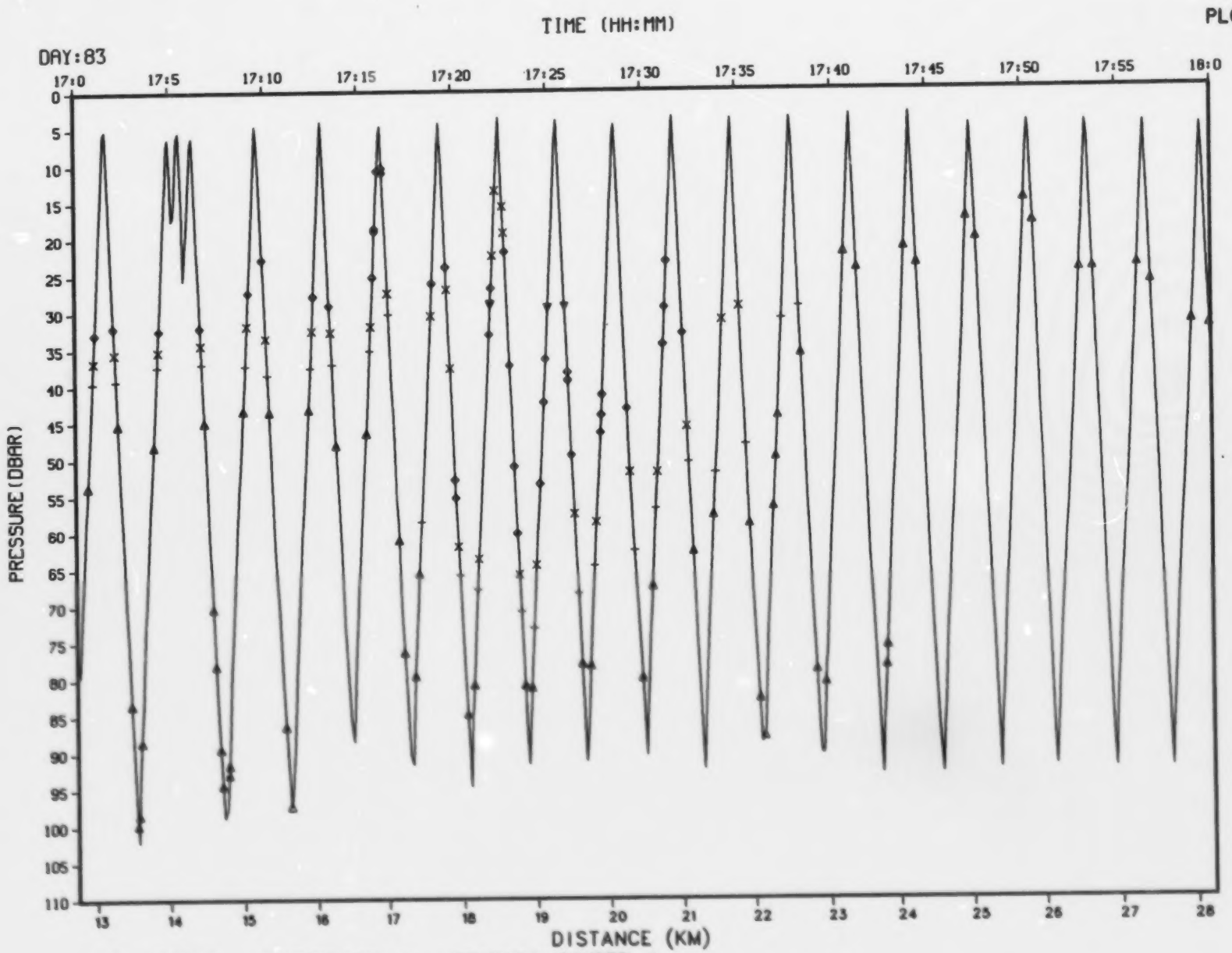

PRESSURE (DBAR)
110
100
90
80
70
60
50
40
30
20
10
0
28.5
SIG-T
TAPE L0662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
6
83 20 35.77
83 20 38.42
83 20 41.06
83 20 43.86
83 20 44.63
83 20 47.13
83 20 49.61
83 20 52.12
83 20 54.54
83 20 57.17
83 20 59.76
83 21 2.21
83 21 4.68
83 21 7.16
83 21 9.69
83 21 12.15
83 21 14.61
83 21 17.13


TAPE LO662 PARTITION 4 STATION NUMBER 1 SIGMA-T SHIFT 0.12
7
83 21 19.53
83 21 21.90
83 21 22.54
83 21 23.87
83 21 26.27
83 21 28.51
SIG-T
26.5
26
0
10
20
30
40
50
60
70
80
90
100
110
PRESSURE (DBAR)

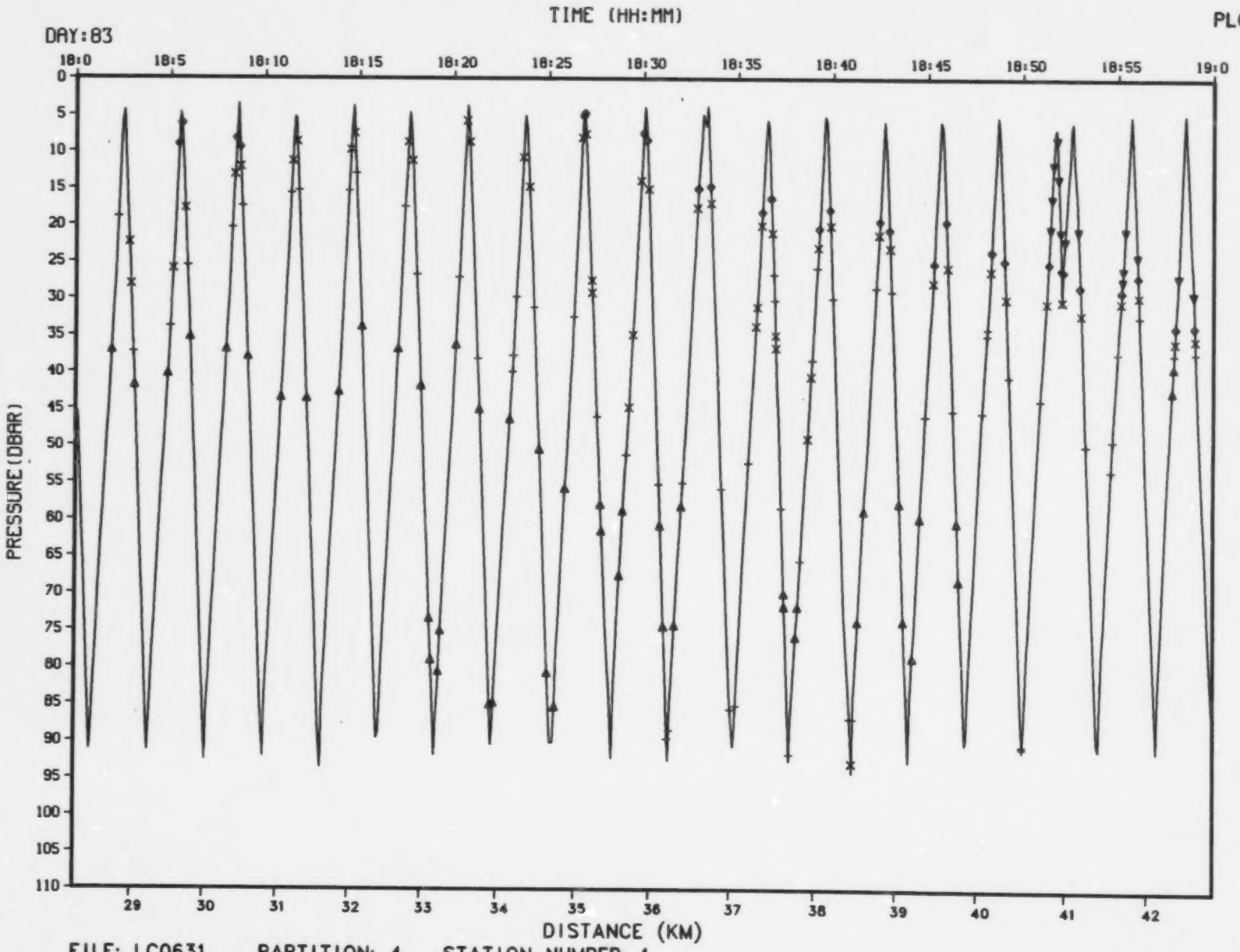
Batfish temperature sections



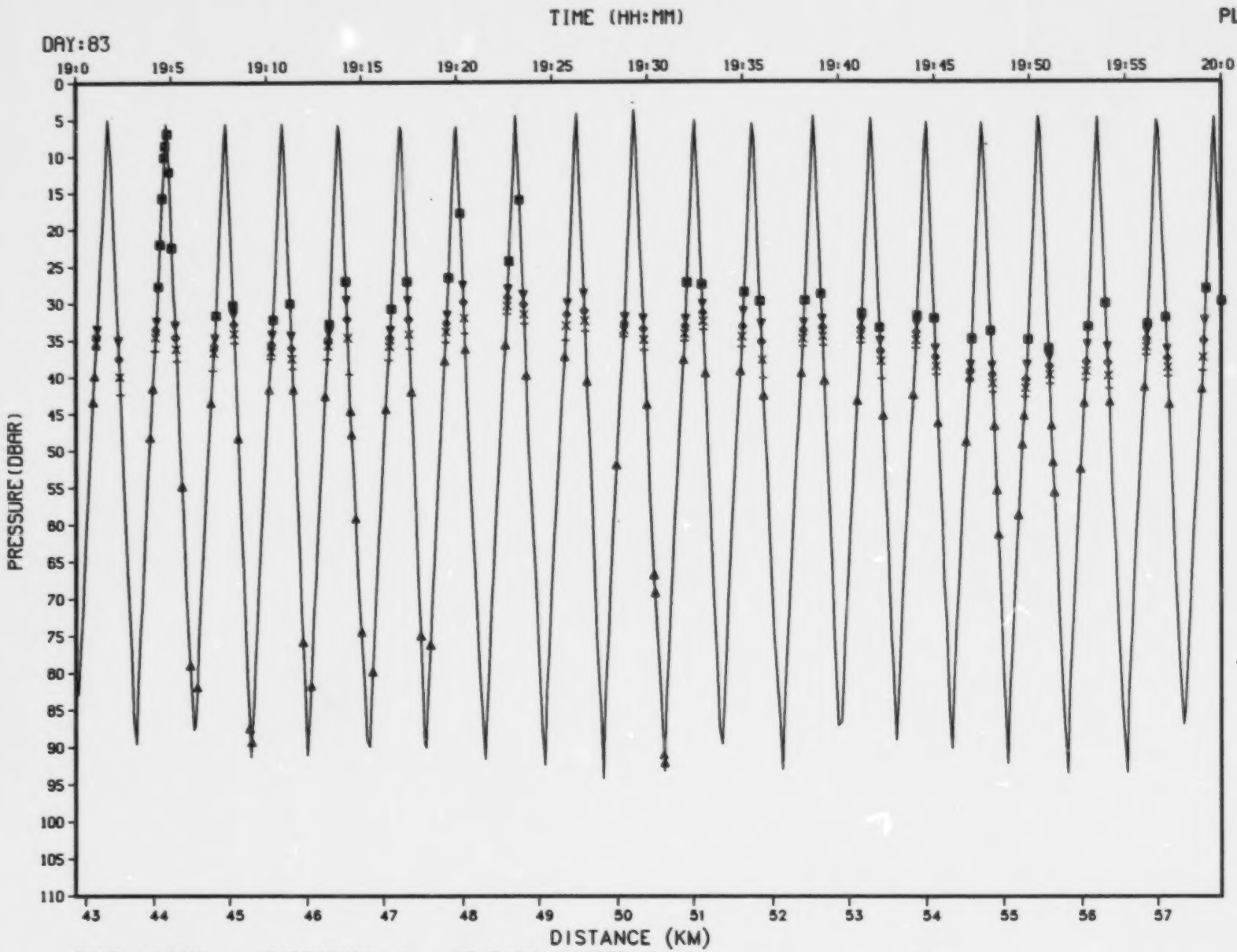
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: △-1.70 +-1.60 X-1.50 ◇-1.40 ▽-1.30 ⊠-1.20
(UNITS: DEG.C)



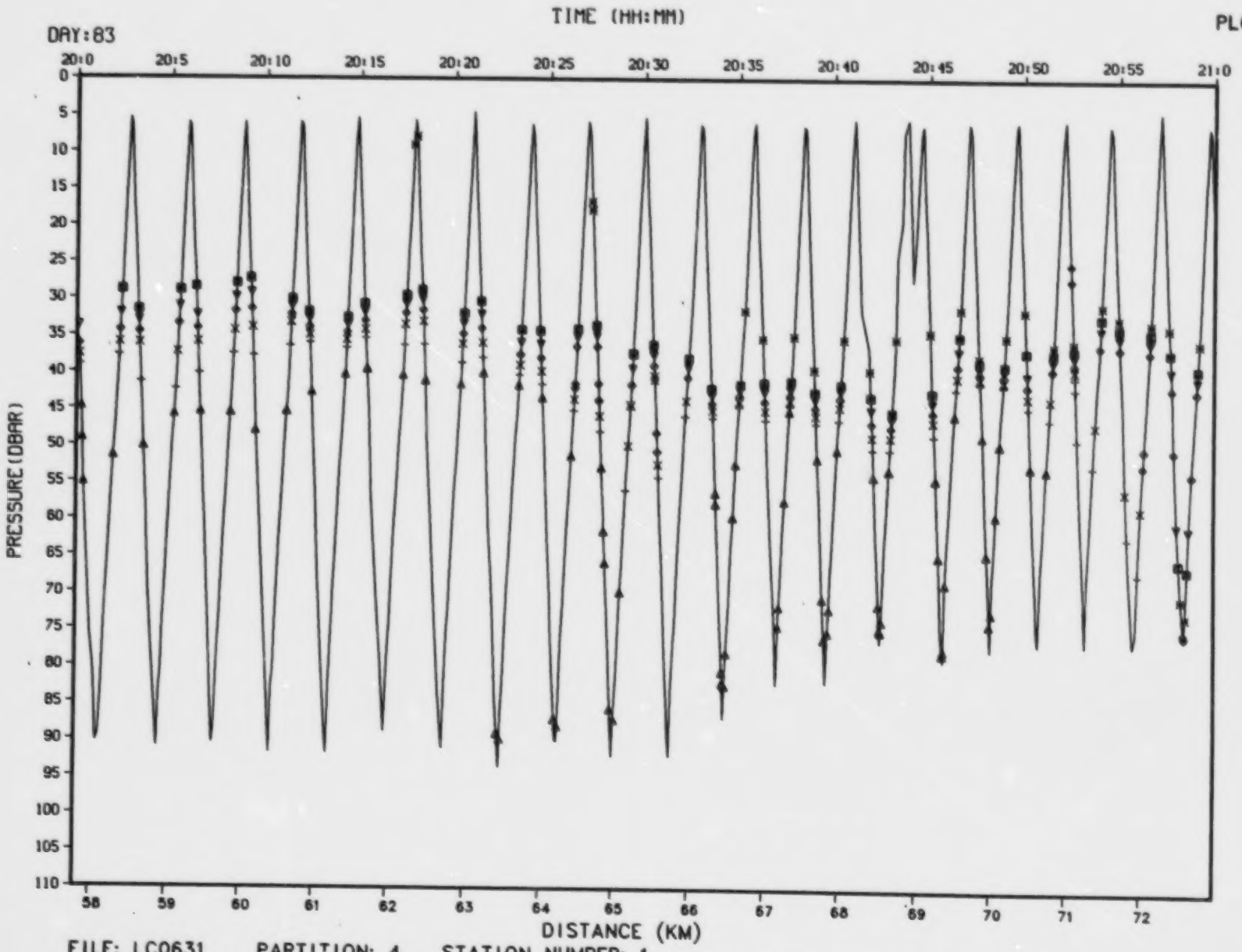
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: △-1.70 +-1.60 X-1.50 ◇-1.40 ▽-1.30
(UNITS: DEG.C)



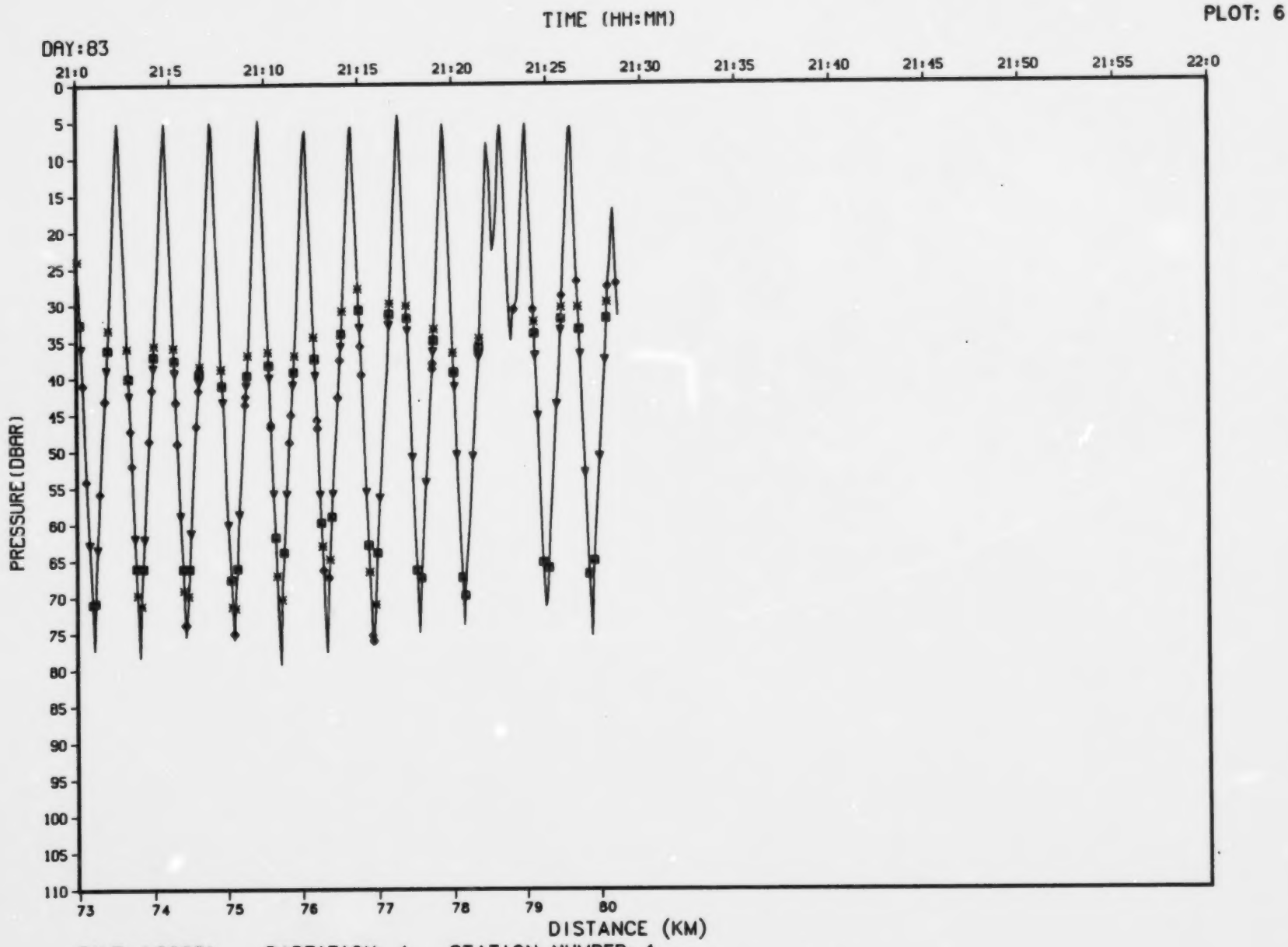
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: △-1.70 +-1.60 X-1.50 ◇-1.40 ▽-1.30
(UNITS: DEG.C)



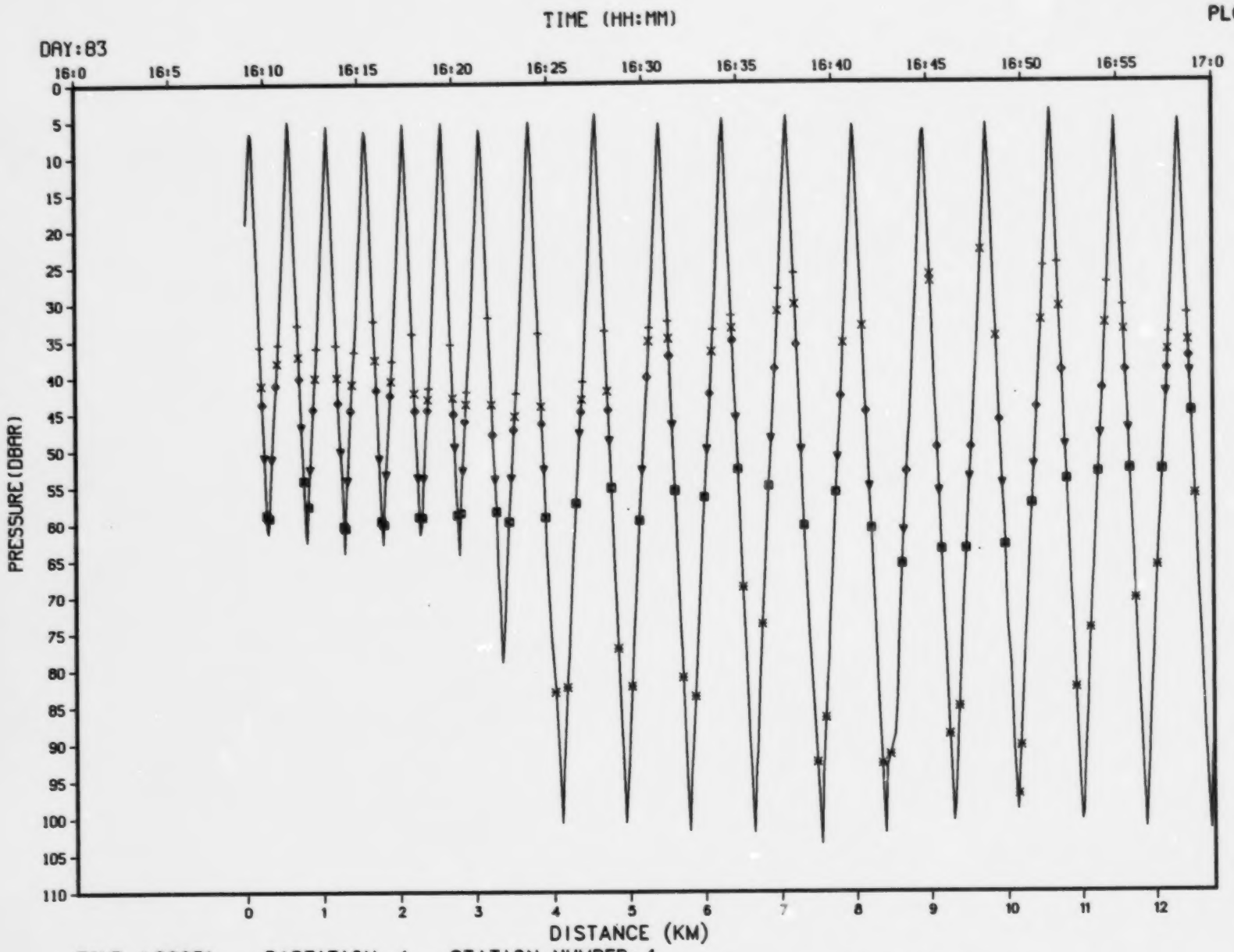
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: △-1.70 +-1.60 X-1.50 ◇-1.40 ▽-1.30 ⊠-1.20
(UNITS: DEG.C)



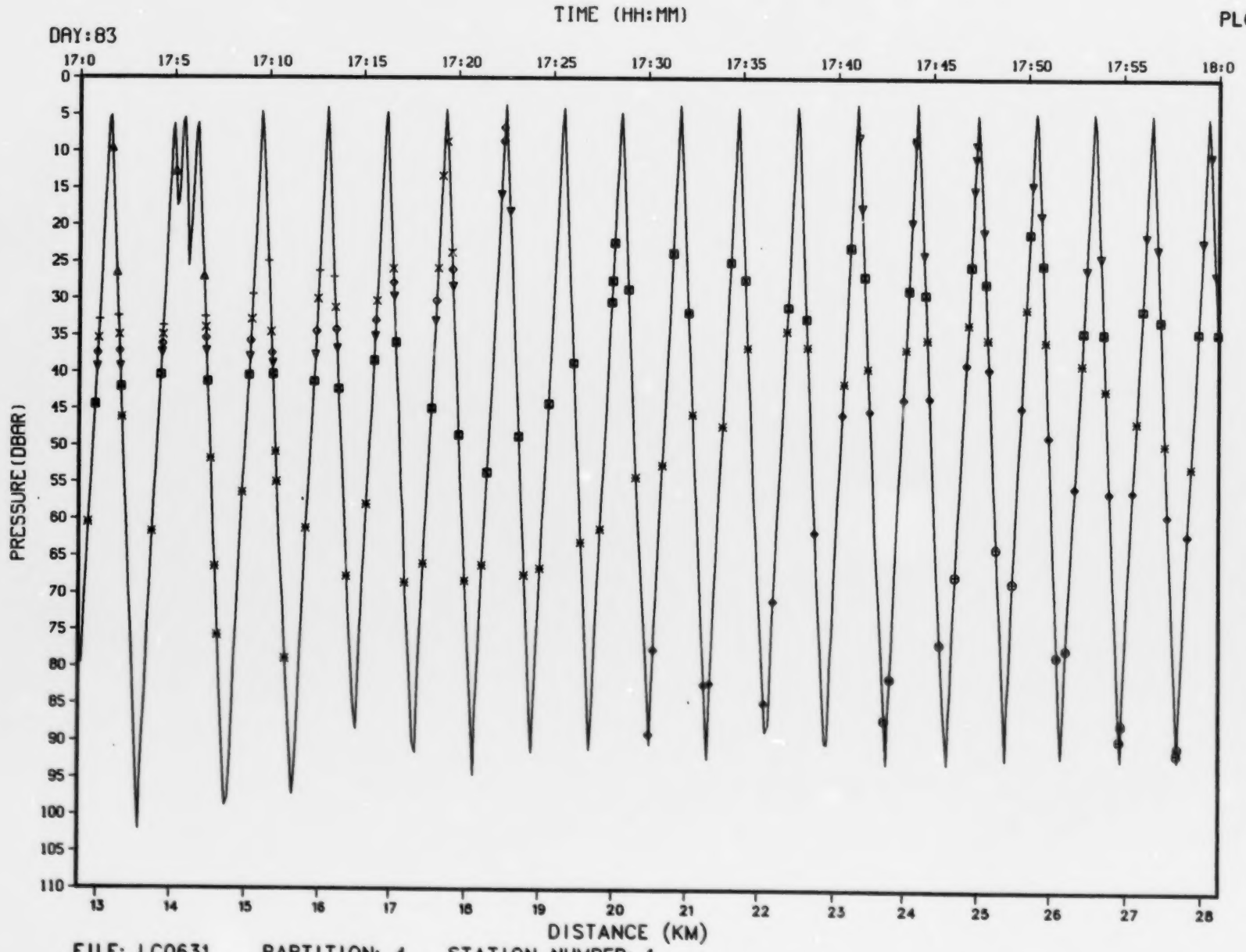
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: Δ-1.70 +-1.60 X-1.50 ◇-1.40 ▽-1.30 ⊠-1.20 ✳-1.10 ⊕-1.00
(UNITS: DEG.C)


TIME (HH:MM)
PLOT: 6
DAY:83
21:0
21:5
21:10
21:15
21:20
21:25
21:30
21:35
21:40
21:45
21:50
21:55
22:0
PRESSURE (DBAR)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
73
74
75
76
77
78
79
80
DISTANCE (KM)
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
TEMPERATURE CONTOUR LEGEND: ◇-1.40 ▽-1.30 ⊠-1.20 ✳-1.10 ⊕-1.00
(UNITS: DEG.C)

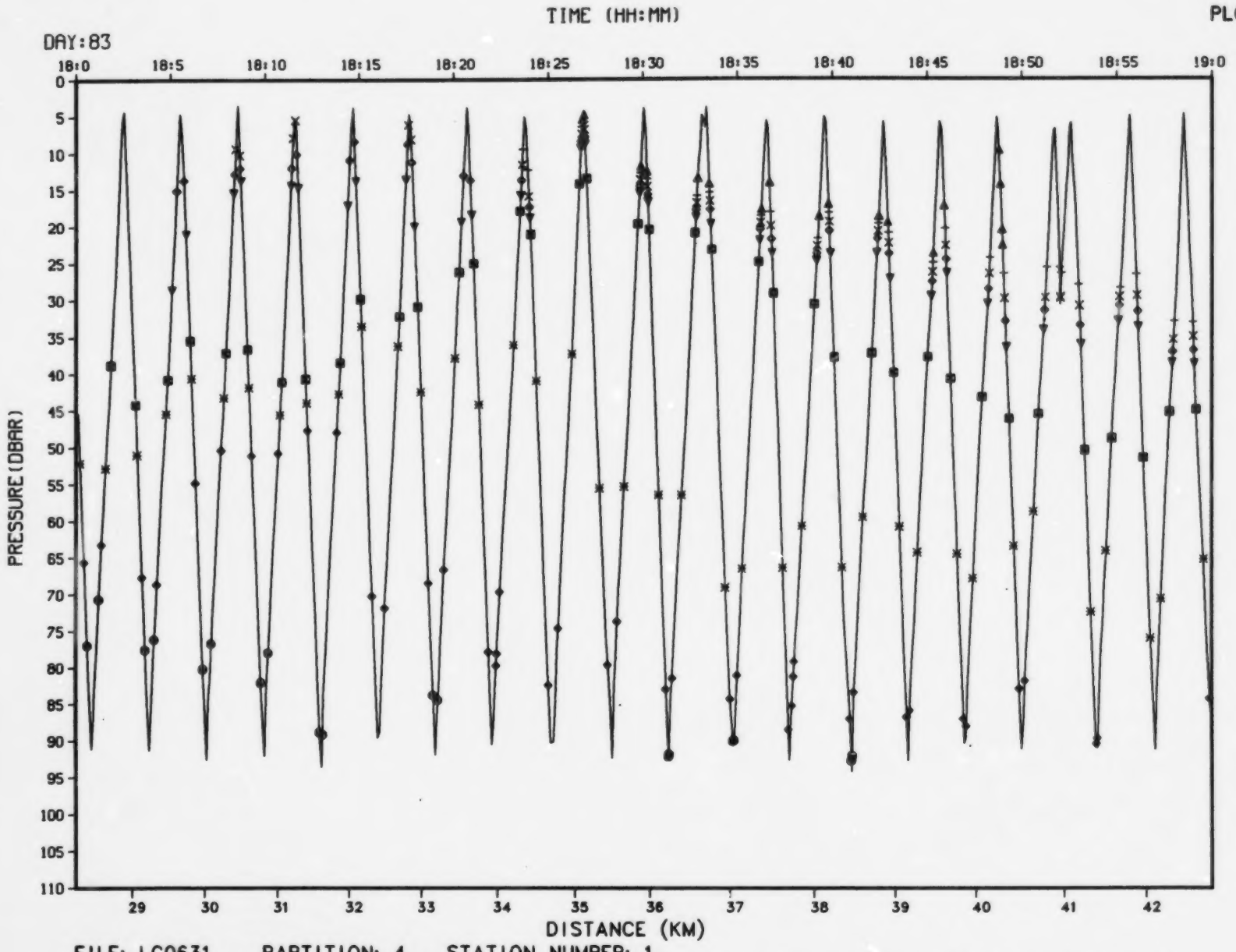
Batfish salinity sections



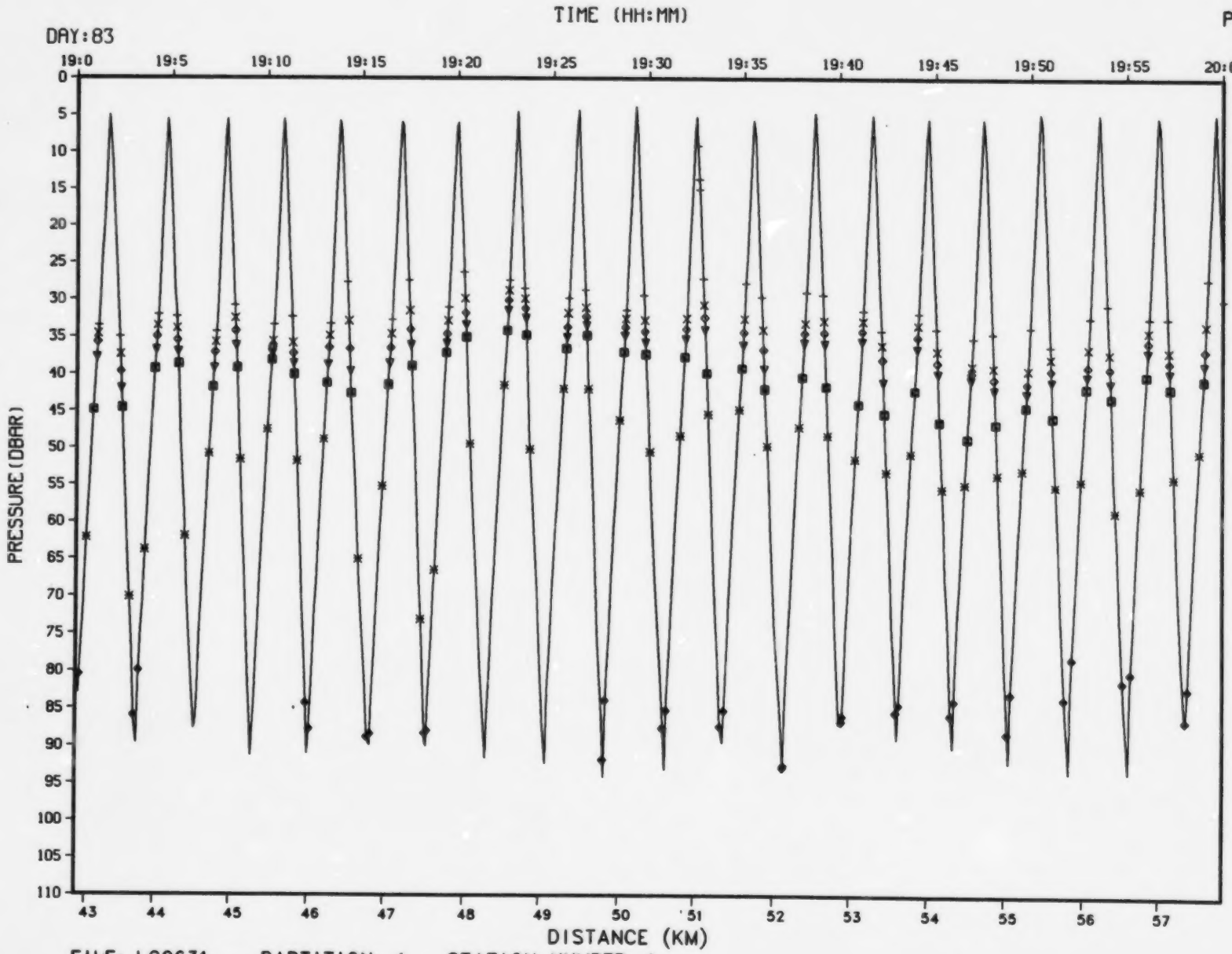
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: + 32.60 × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ⋇ 32.85
(UNITS: PPT)



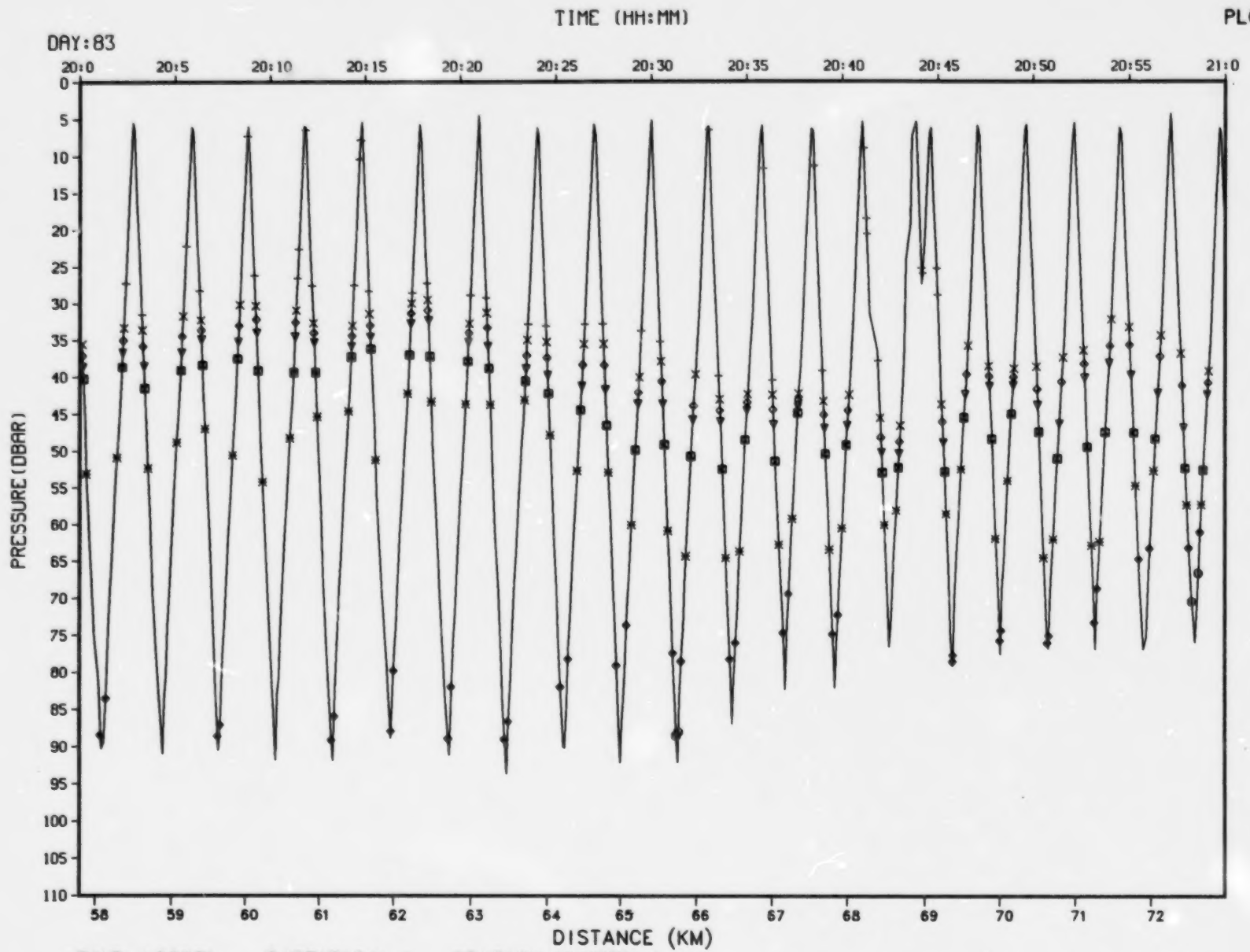
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: △ 32.55 + 32.60 × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ✳ 32.85 ⊕ 32.90
(UNITS: PPT) ⊕ 32.95



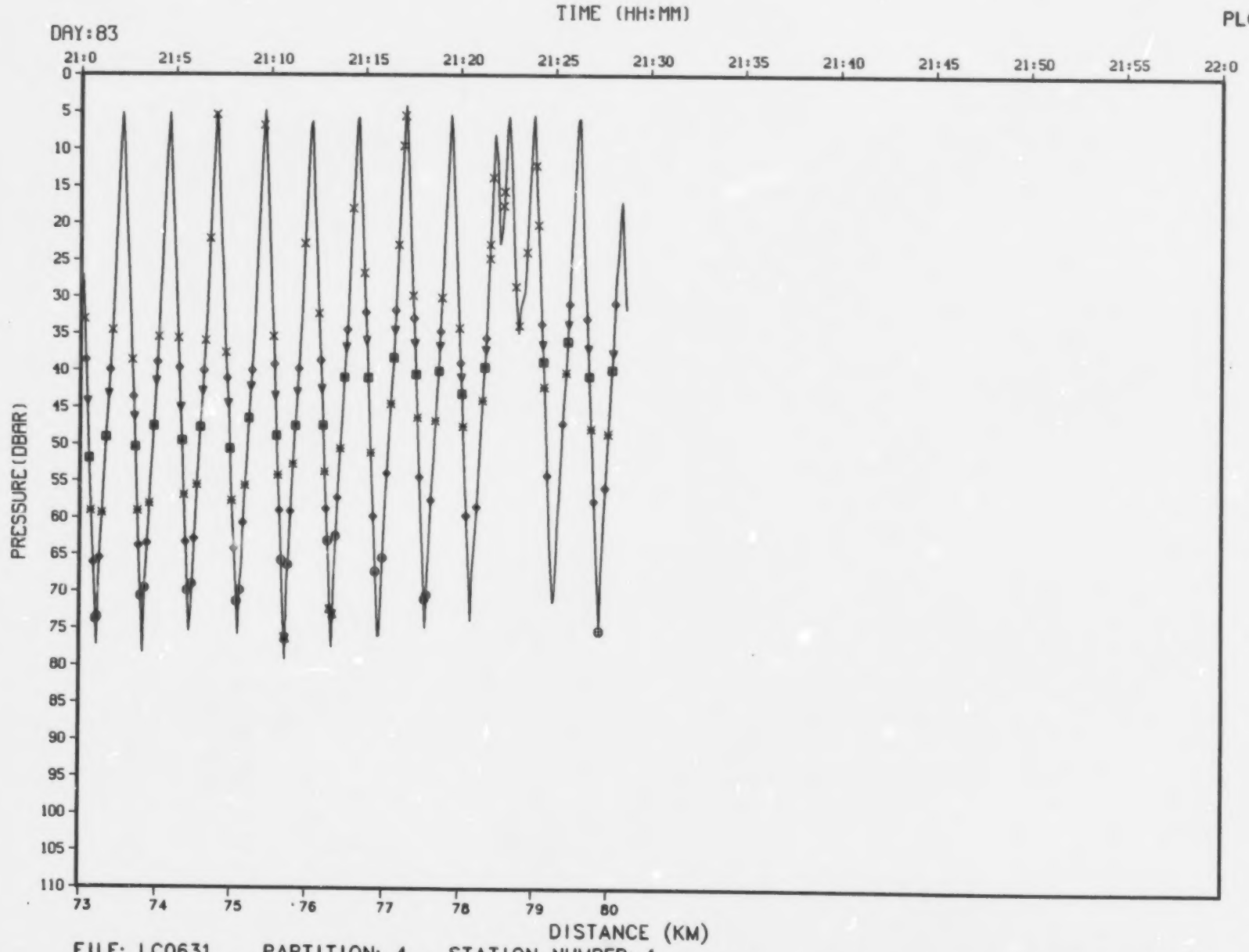
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: △ 32.55 + 32.60 × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ✳ 32.85 ⊕ 32.90
(UNITS: PPT) ⊕ 32.95



FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: + 32.60 × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ✳ 32.85 ⊕ 32.90
(UNITS: PPT)

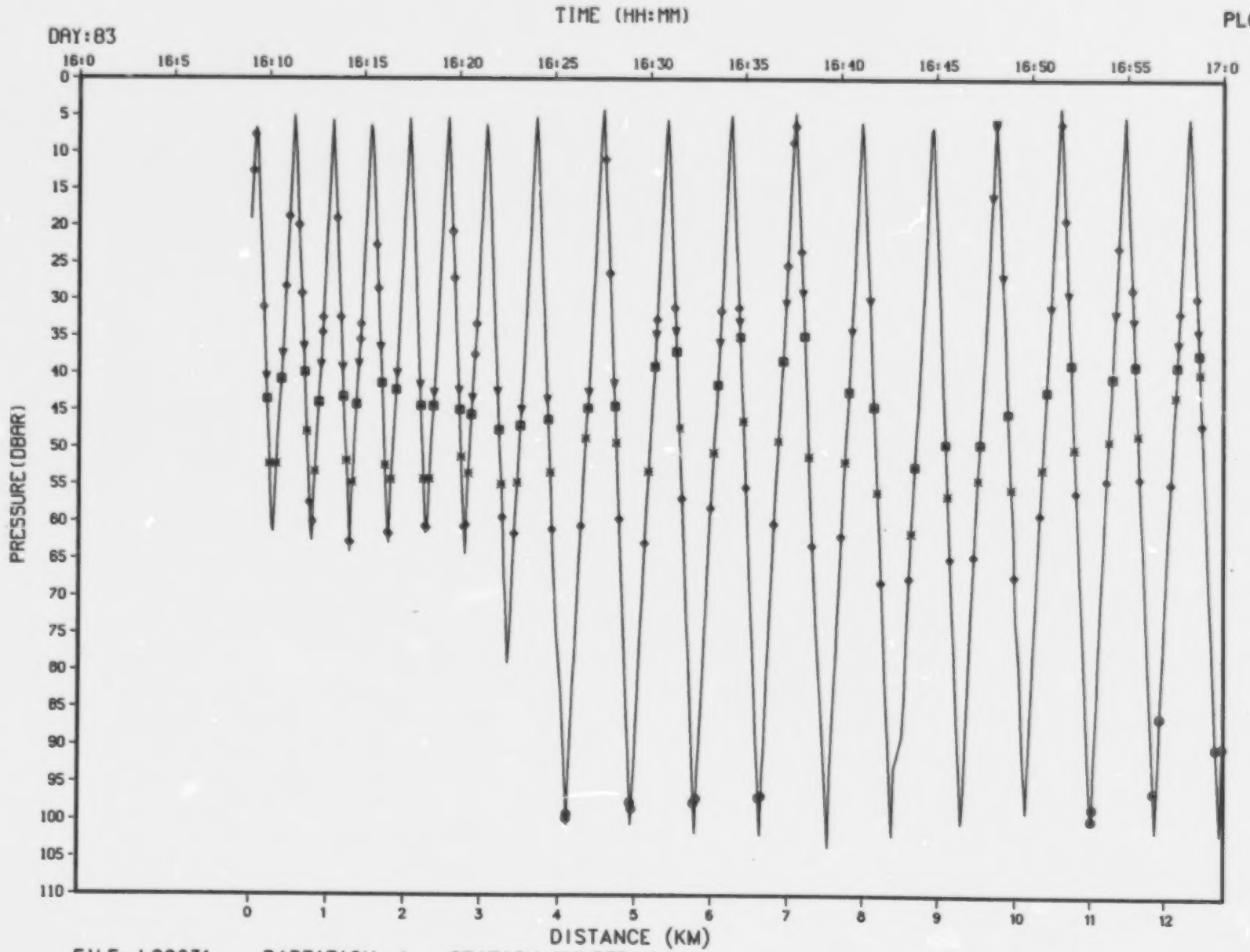


FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: + 32.60 × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ✳ 32.85 ⊕ 32.90 ⊕ 32.95
(UNITS: PPT)

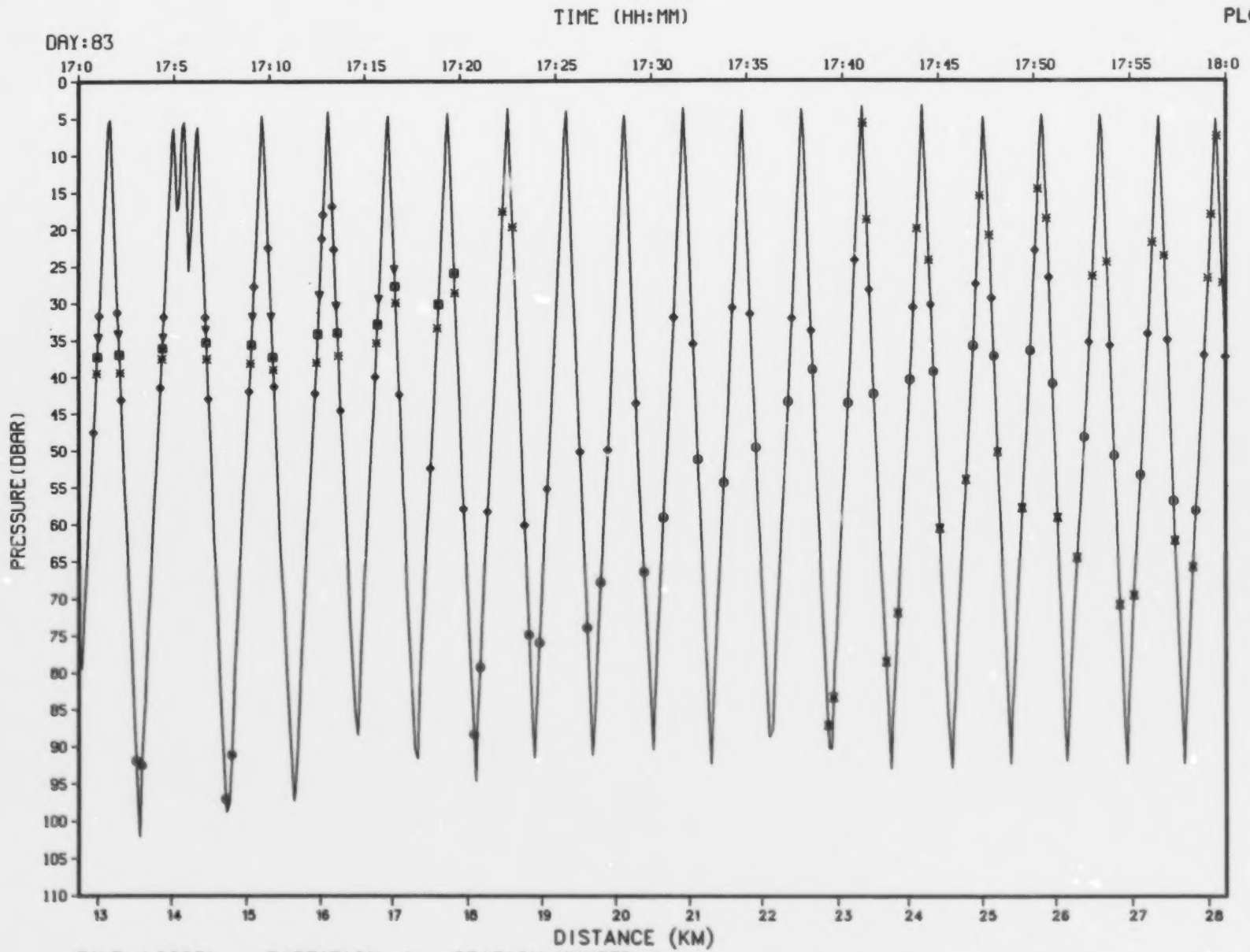


FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SALINITY CONTOUR LEGEND: × 32.65 ◇ 32.70 ▽ 32.75 ⊠ 32.80 ✳ 32.85 ⊕ 32.90 ⊕ 32.95 ⊠ 33.00
(UNITS: PPT)

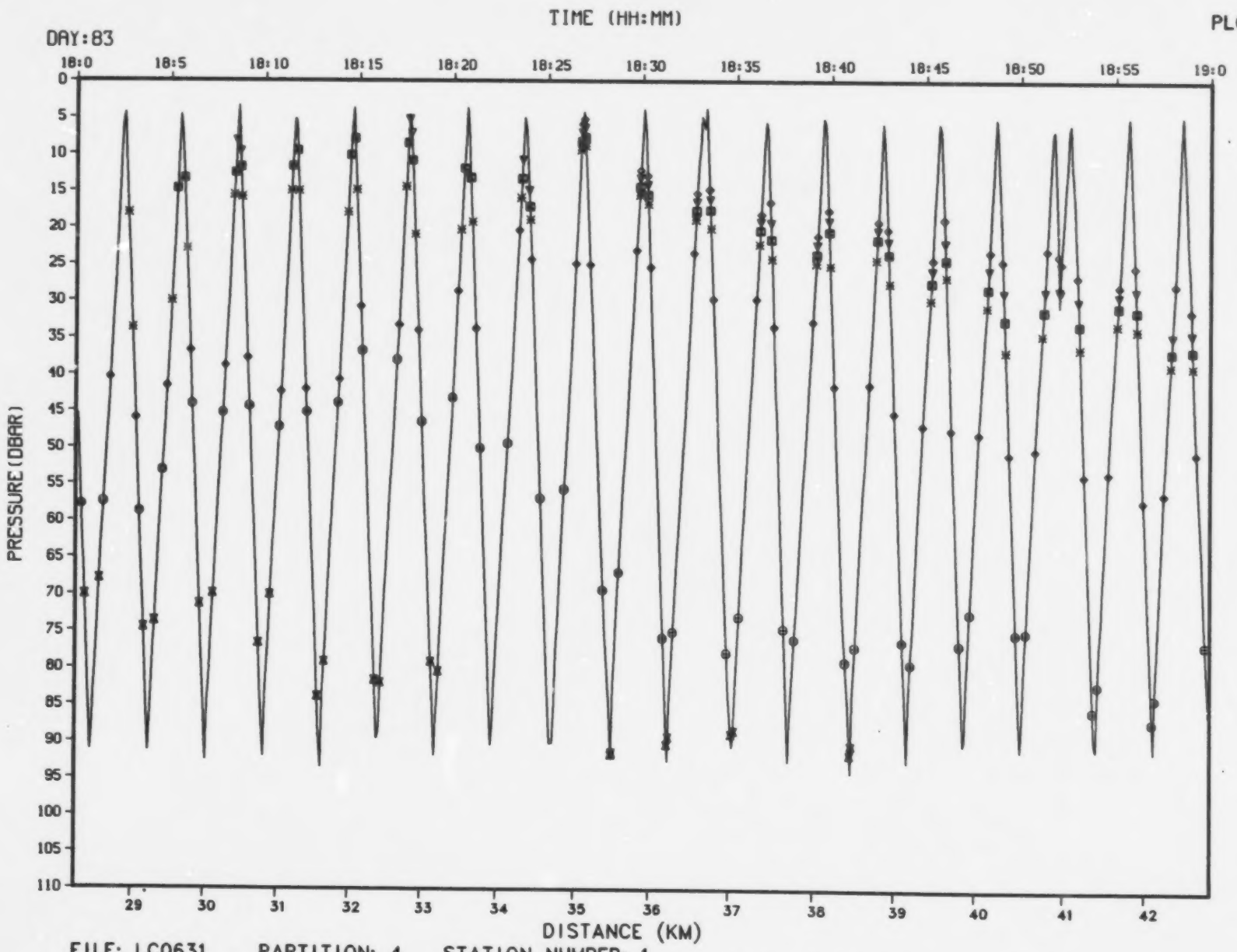
Batfish σ_t sections



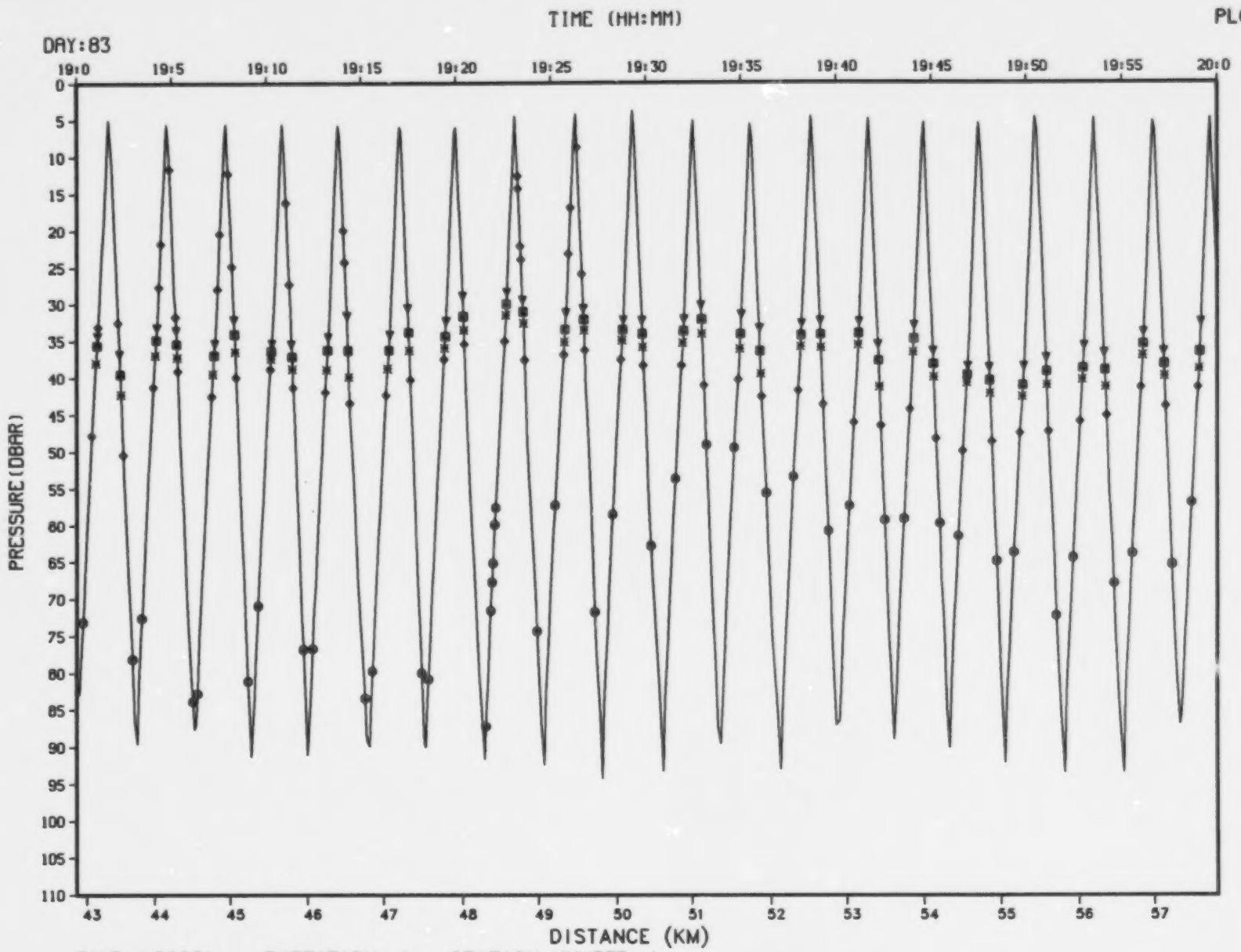
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ◇ 26.20 ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45
(UNITS: KG/M**3)



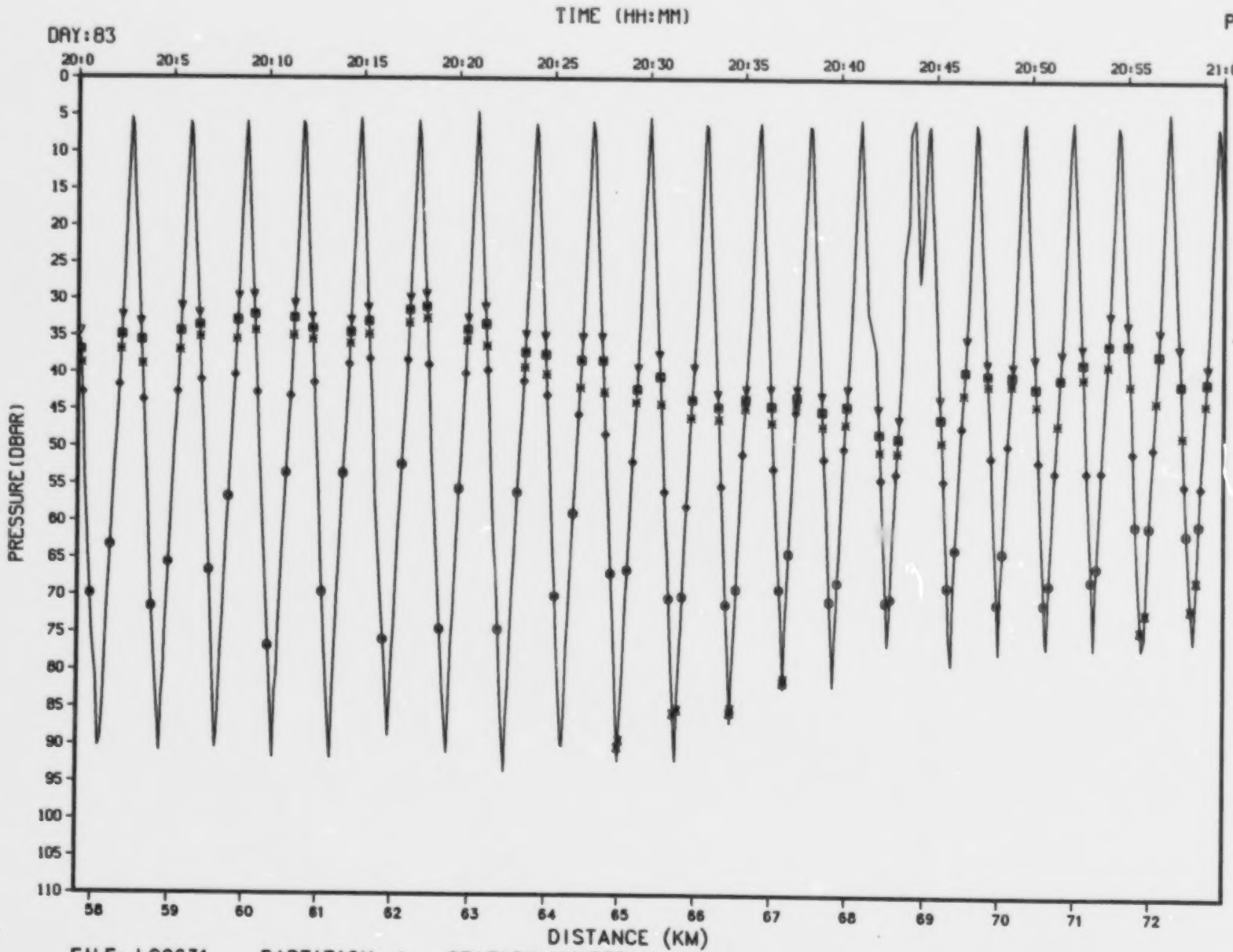
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ◇ 26.20 ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45 ⊠ 26.50
(UNITS: KG/M**3)



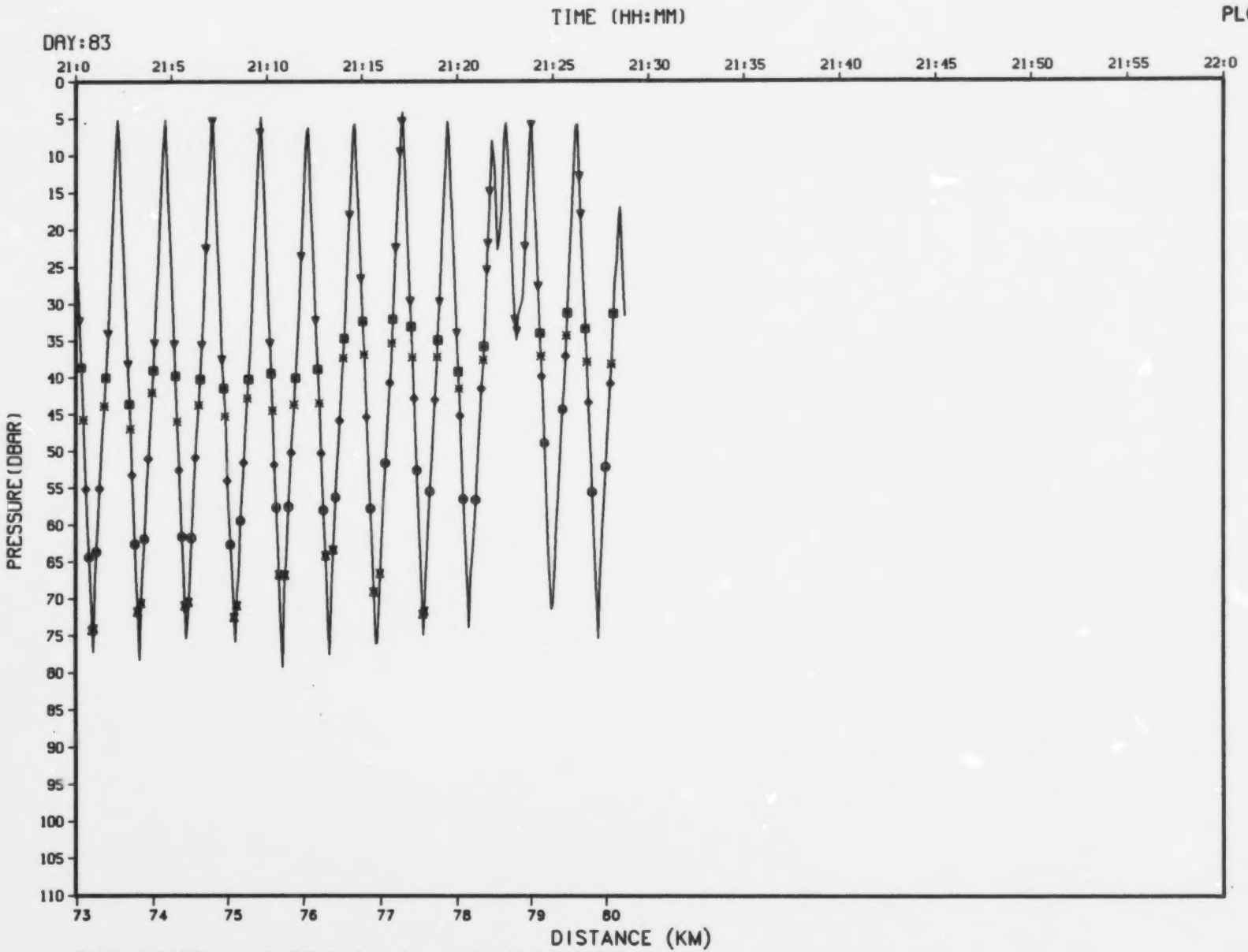
FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ◇ 26.20 ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45 ⊠ 26.50
(UNITS: KG/M**3)



FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ◇ 26.20 ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45
(UNITS: KG/M**3)



FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45 ⊠ 26.50
(UNITS: KG/M**3)



FILE: LC0631 PARTITION: 4 STATION NUMBER: 1
SIGMA-TH CONTOUR LEGEND: ▽ 26.25 ⊠ 26.30 ✳ 26.35 ⊕ 26.40 ⊕ 26.45 ⊠ 26.50
(UNITS: KG/M**3)

10. Drifter data

Two types of drifters were used: Accurate Surface Tracker (AST) manufactured by Seimac Ltd. and thermistor chain drifter supplied by G. Fowler of B.I.O.. AST is a light-weight drifter with a barrel-shaped hull measuring 45 cm in diameter and 77 cm in height, and can be deployed manually from a boat or a helicopter. The thermistor chain drifter has a 55 m cable with 8 thermistors connected to the bottom of a cone-shaped hull. Because of its heavy weight (41 kg) and large size, deployment was conducted from the ship with the help of a crane.

The data are summarized in the following table.

Drifter number	Deployment date and time	Position at deployment	Date and time of last fix	Site	Method	Remarks
2750 AST	March 22(81) 1300Z	47.330N 52.256W	April 27(117) 2311Z	W	L	1 km from ice edge
2759 AST	March 25(84) 1052Z	46.566N 52.831W	April 6(96) 2118Z	I I	S S	Omegasonde target on site
2758 AST	March 25(84) 1140Z	46.546N 52.858W	March 31(90) 2147Z	I I	S S	Omegasonde target on site
2751 AST	March 25(84) 1402Z	46.463N 52.929W	March 31(90) 2327Z	I I	S S	Omegasonde target on site
2752 AST	March 25(84) 1900Z	46.517N 53.217W		I	H	Transmissi failed aft deployment
2488 T-chain	March 25(84) 2200Z	46.423N 52.992W	April 30(120) 2057Z	W	S	

Notes: Date - Julian day in bracket
Site - "I" on ice, "W" in water
Method - deployed from ship "S", launch "L", helicopter "H"

The drifter tracks are plotted in pp.153 to 157. The numbers beside the tracks indicate the dates and positions of the first fix of the day (Julian). Dates and times of the first and last data points are also given.

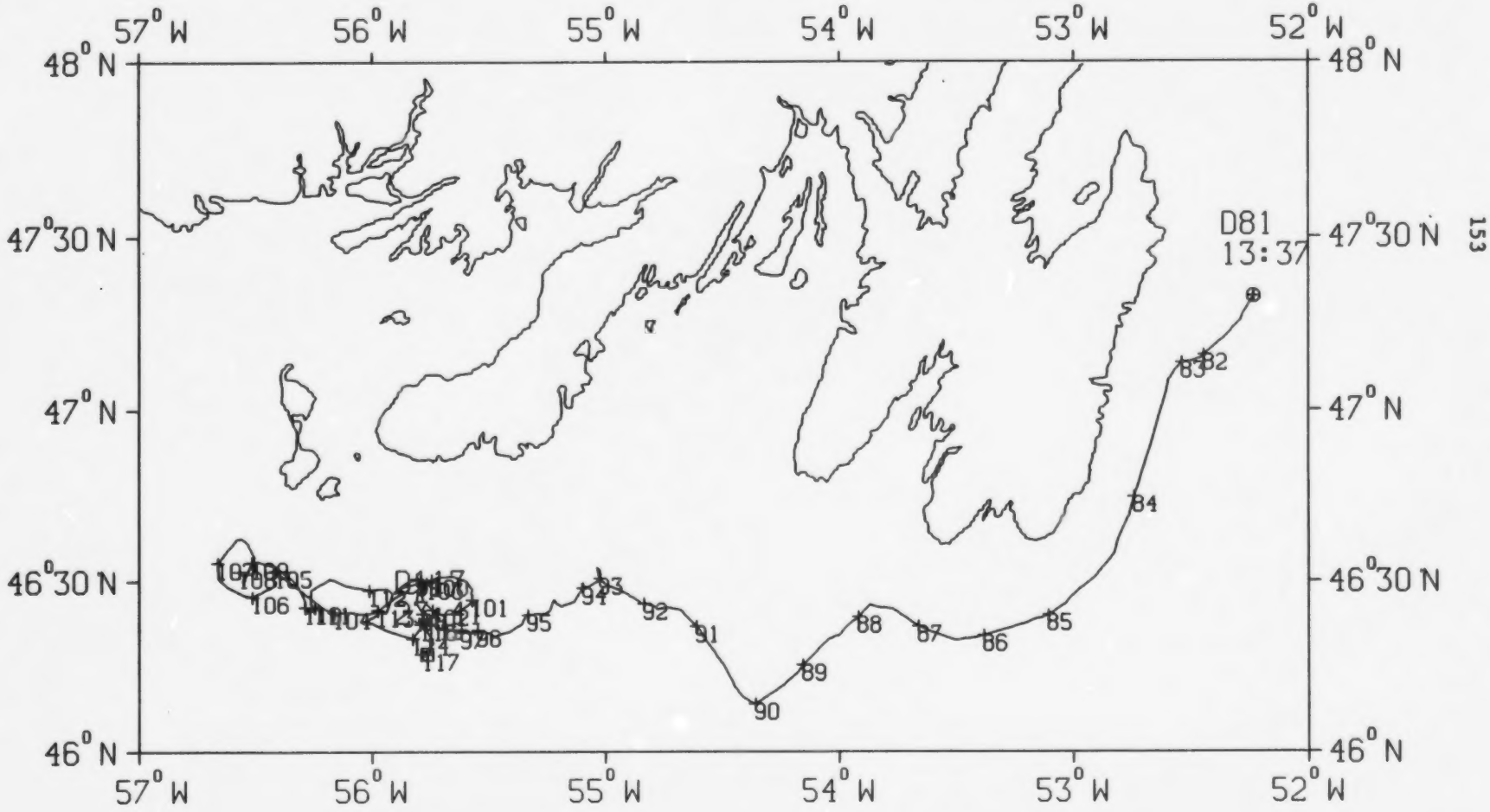
Drifter velocities are obtained by fitting the north-south and the east-west coordinates in a 3-day window with polynomials. The derivatives of the polynomials with respect to time at the mid-point of the 3-day window give the north and east components of the velocity vectors. The degree of the polynomials used in the computation varied from 2 to 4 depending on the degree of smoothness of the data. This method does not give a pre-determined frequency response, but the advantage is that positions and velocities at equally spaced time interval can be obtained with some control of the smoothness of the fitted curves.

Pages 159 to 165 show the fitted time series calculated at 3-hour interval superimposed on the data points. The vertical axes are the north- and east- coordinates (labelled "Latitude" and "Longitude") in km of the drifter positions. The origin is at 46^{0}N, 57^{0}W. The derived velocities for each drifter are shown in pp.167 to 173. The time interval between succesive vectors is 0.5 day. Velocities from all the drifters at given times are shown in pp.175 to 193, where the white (black) arrow heads indicate the drifters in water (on ice). Pages 195 and 196 are composite plots of all the velocity vectors at one day interval.

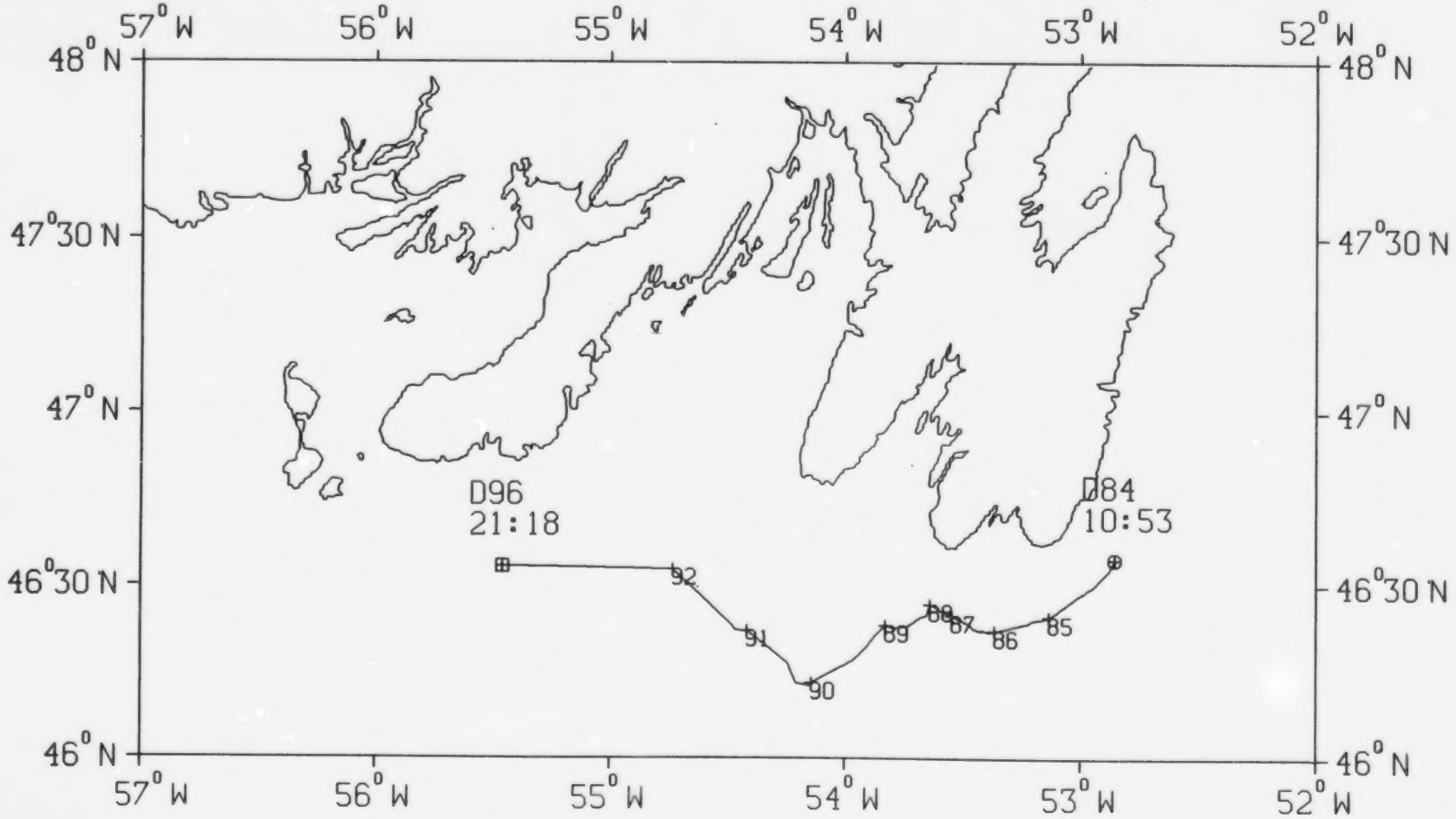
The thermistor chain drifter has thermistors at 0.7 m, 5 m, 10 m, 15 m, 25 m, 35 m, 45 m and 55 m. There are no data for March for 10 m, 15 m and 55 m due to processing errors. The remaining data for March (days 84-91) and data for April (days 91-120) are shown in pp.198 to 200.

Drifter tracks

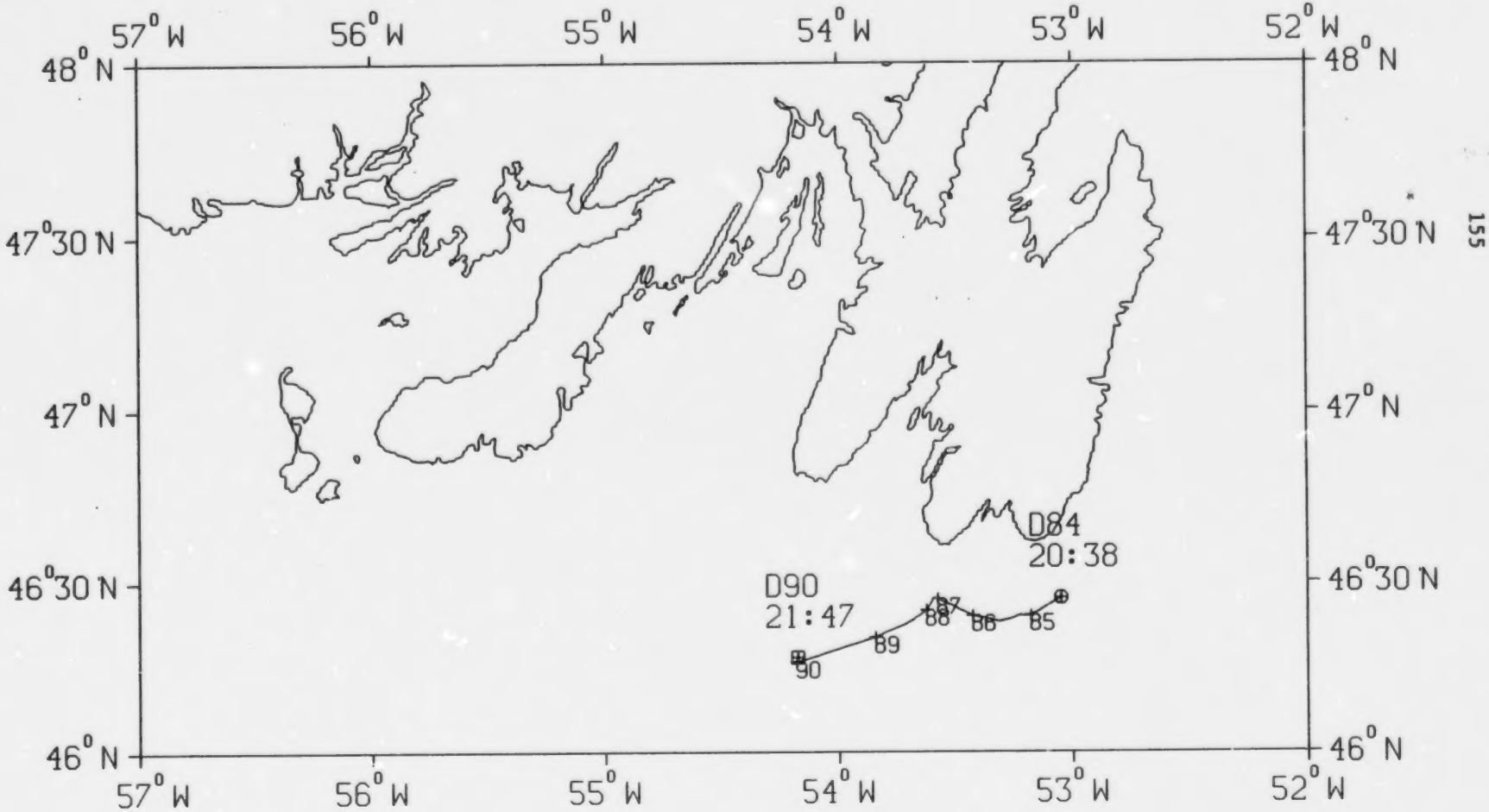
BAFFIN 87002
DRIFTER NO.2750



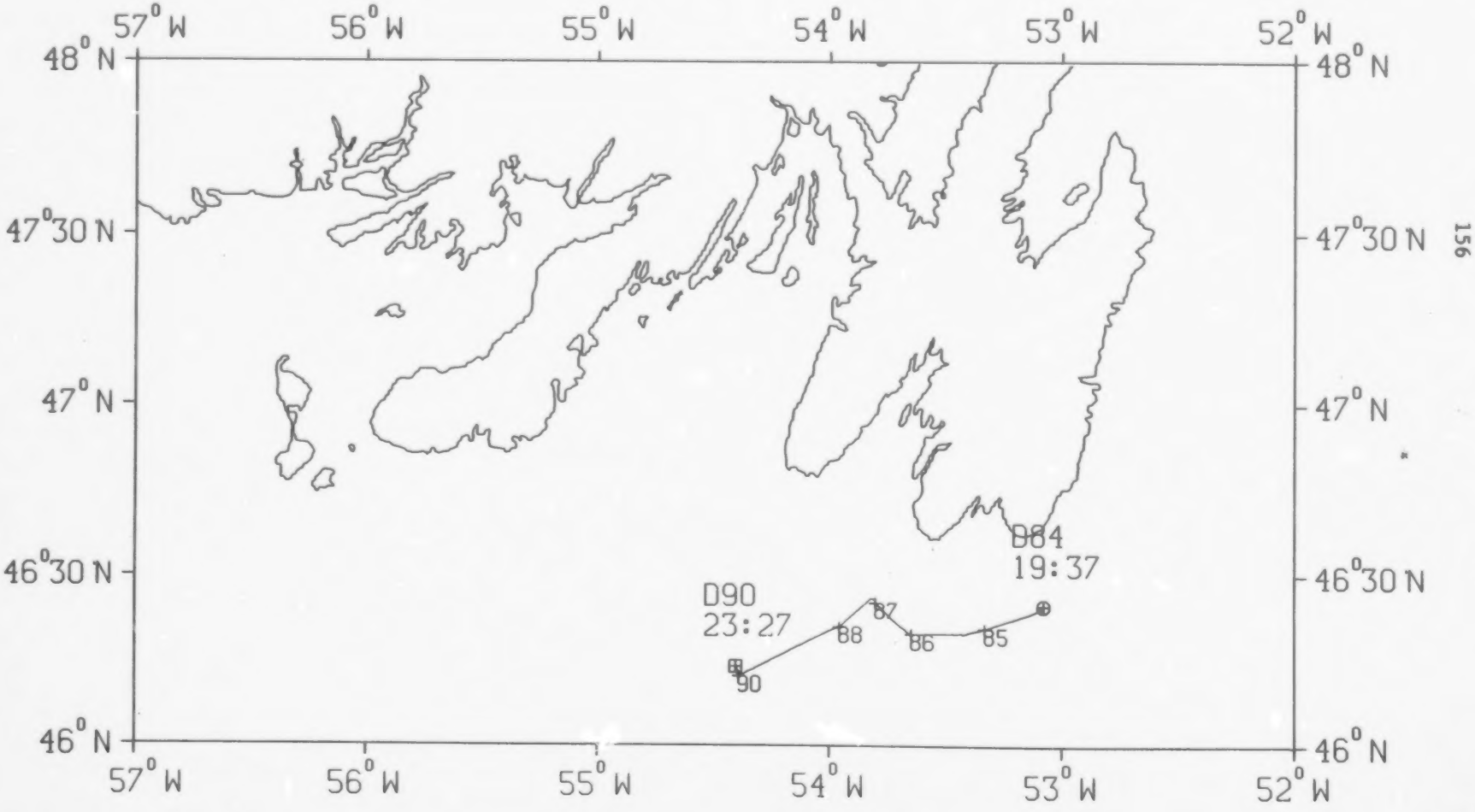
BAFFIN 87002
DRIFTER NO.2759



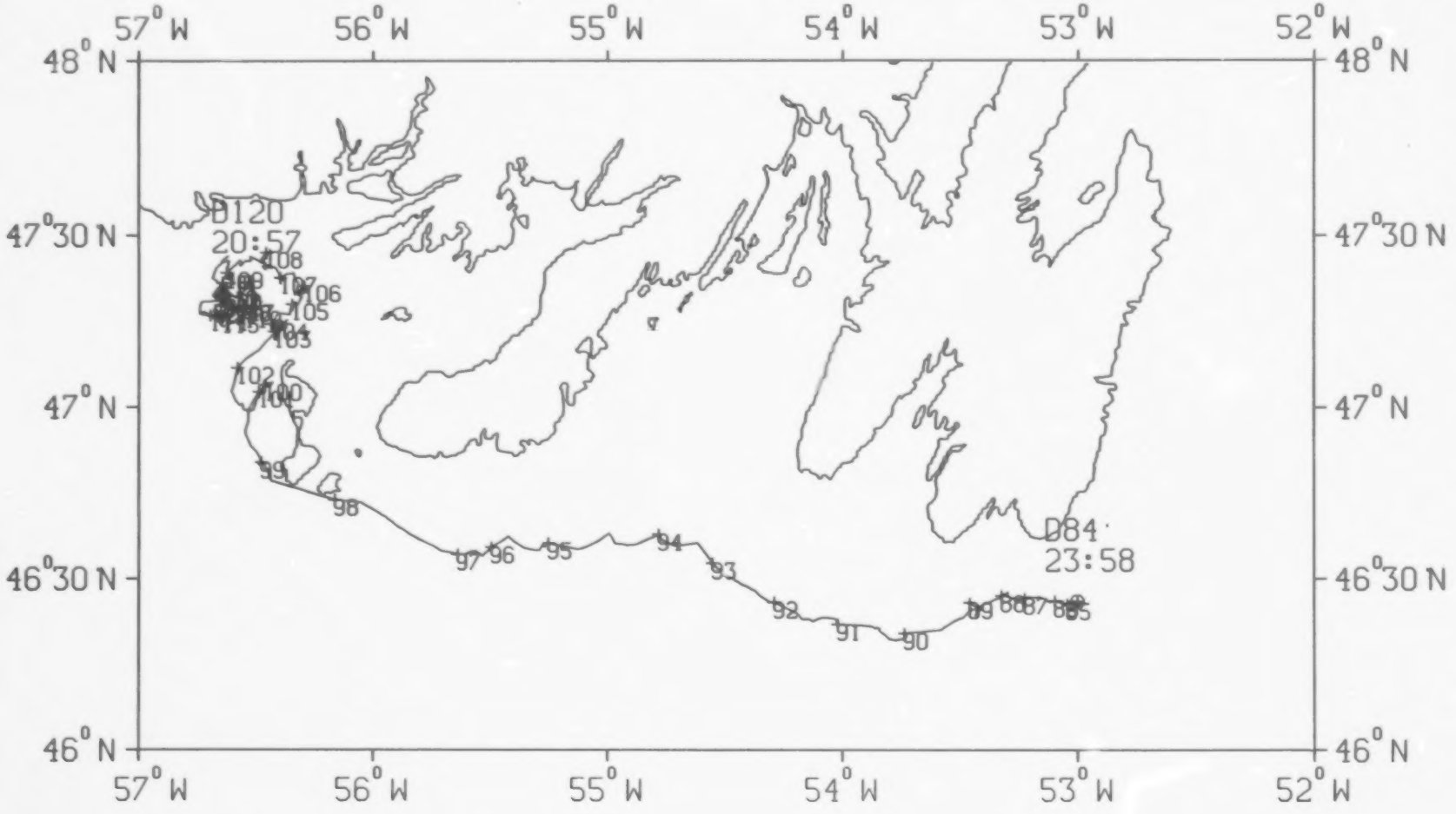
BAFFIN 87002
DRIFTER NO.2758



BAFFIN 87002
DRIFTER NO.2751

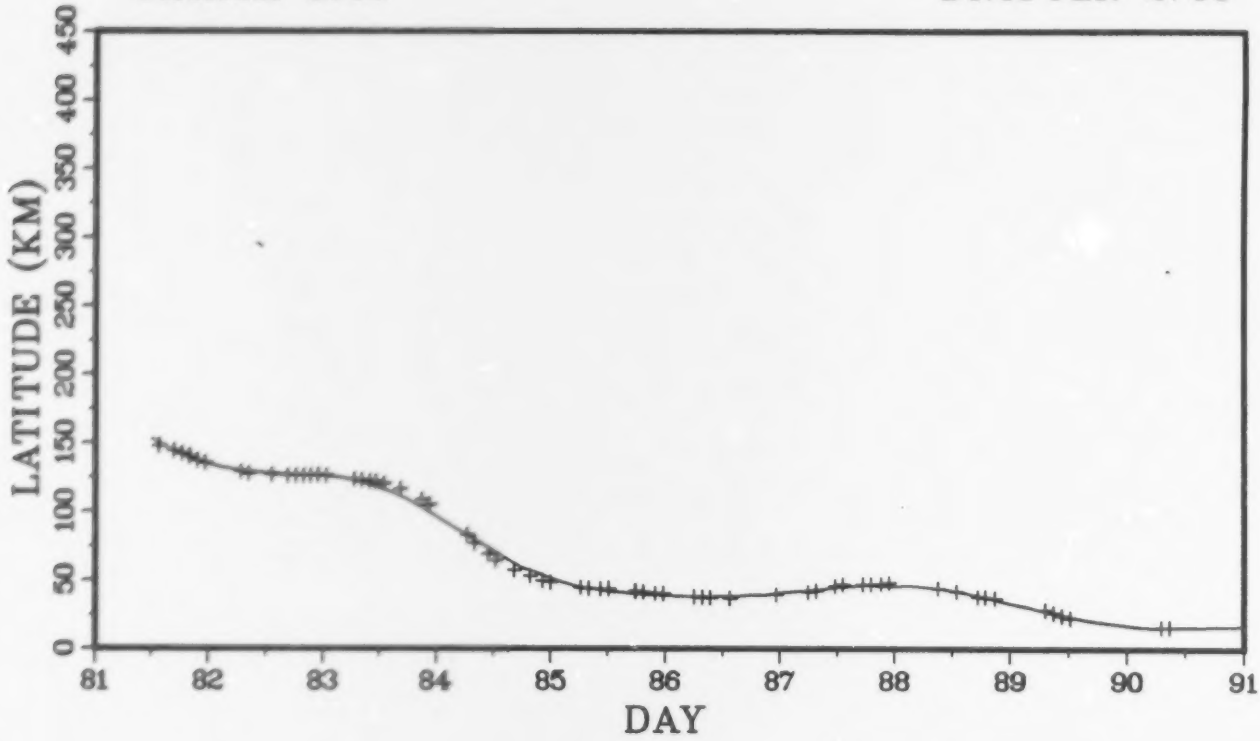


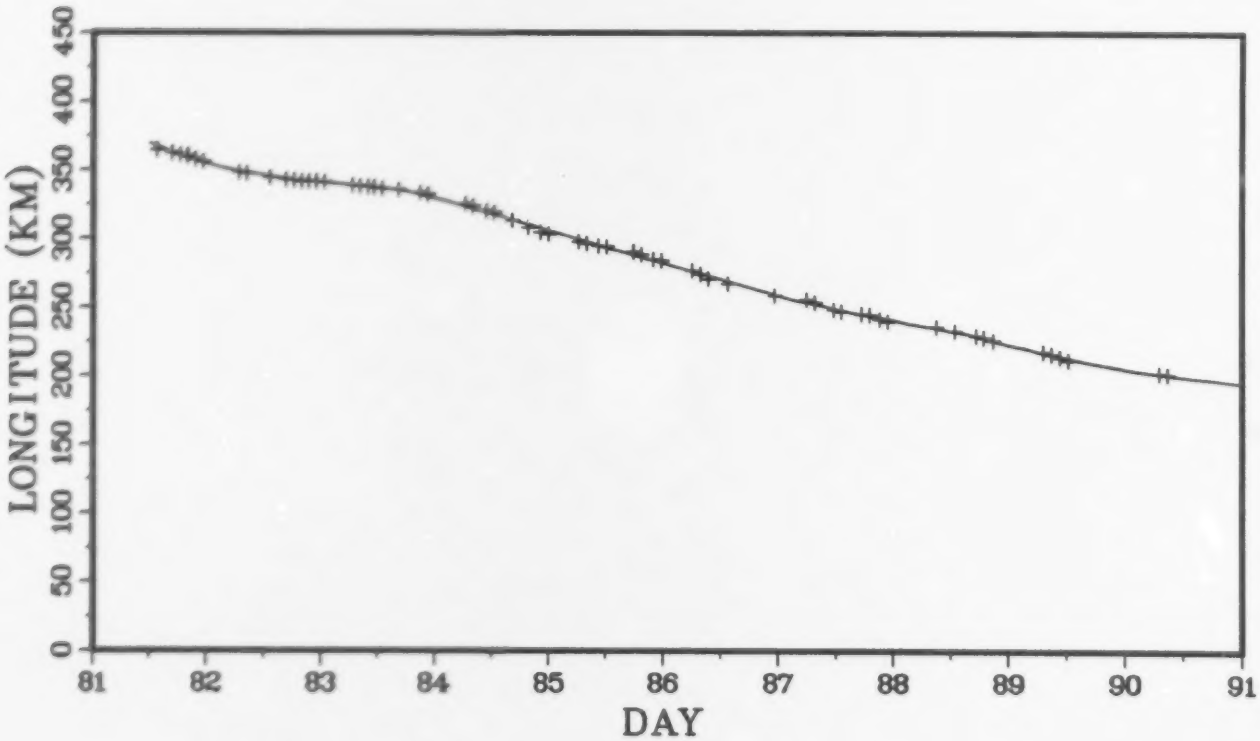
BAFFIN 87002
T-CHAIN DRIFTER NO.2488



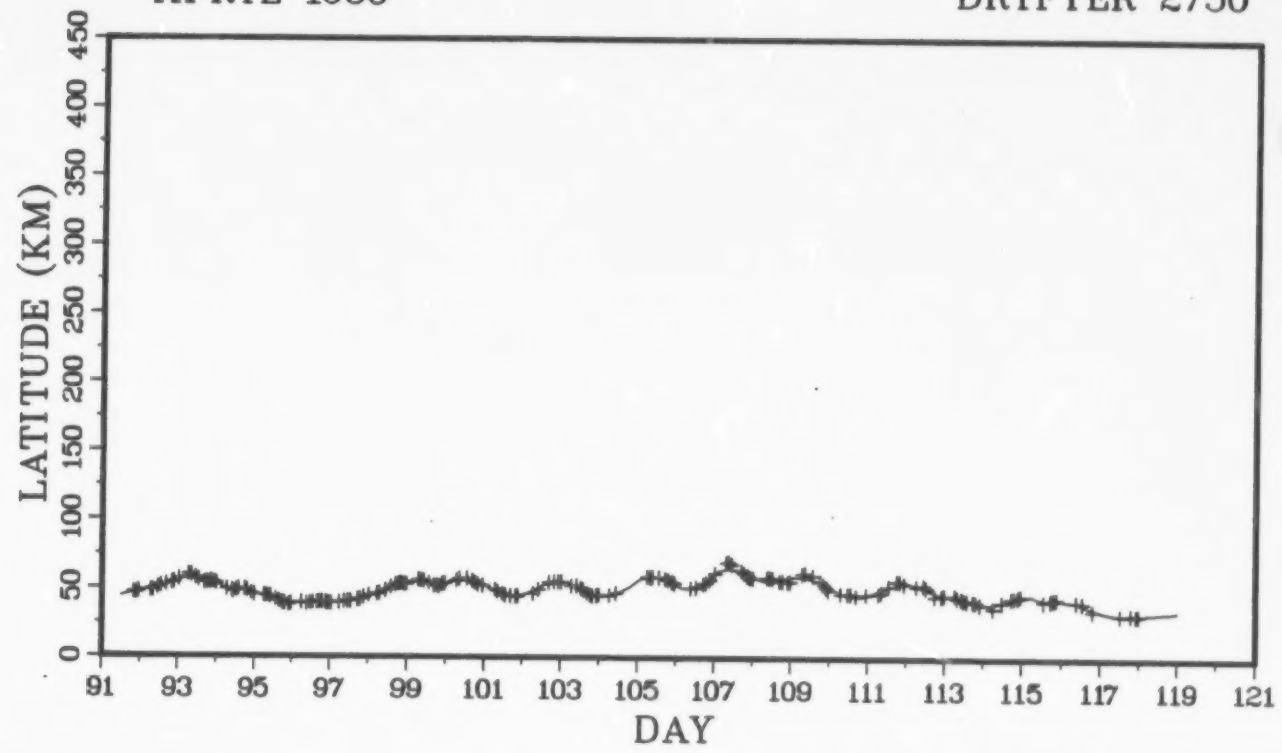
Polynomial fits of drifter positions

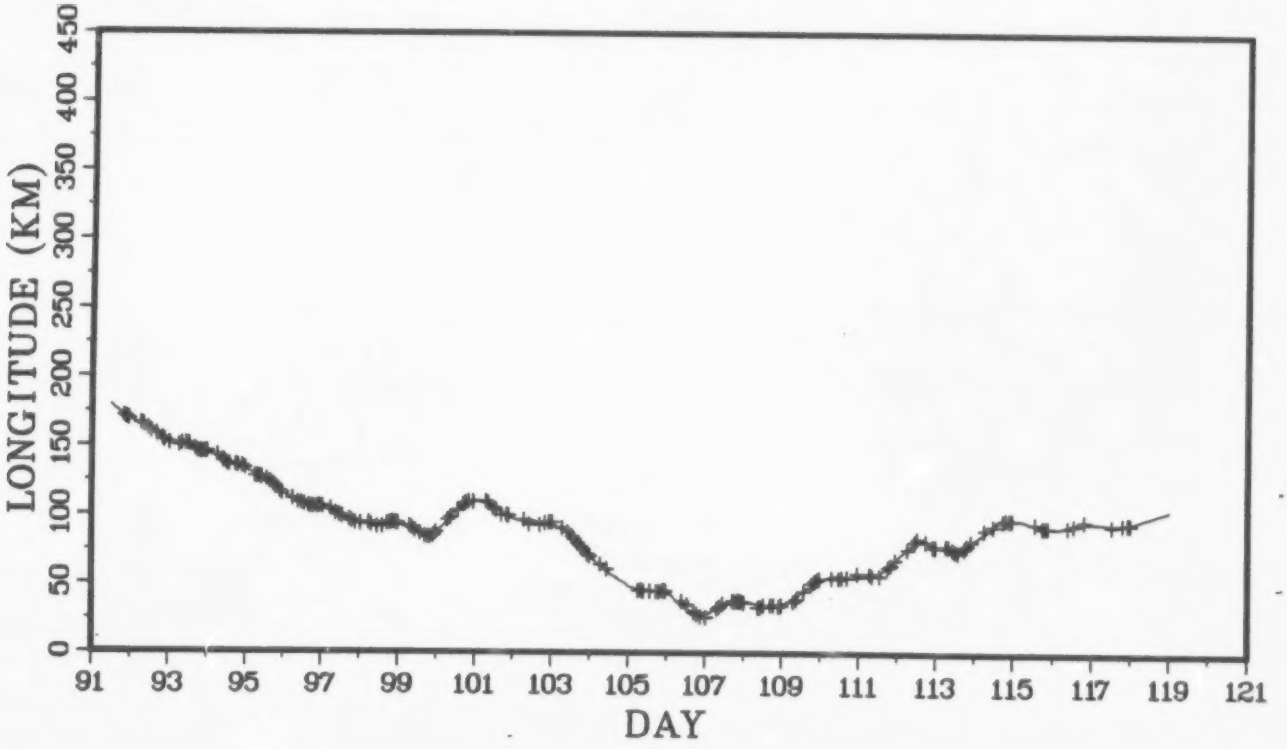
MARCH 1986 DRIFTER 2750



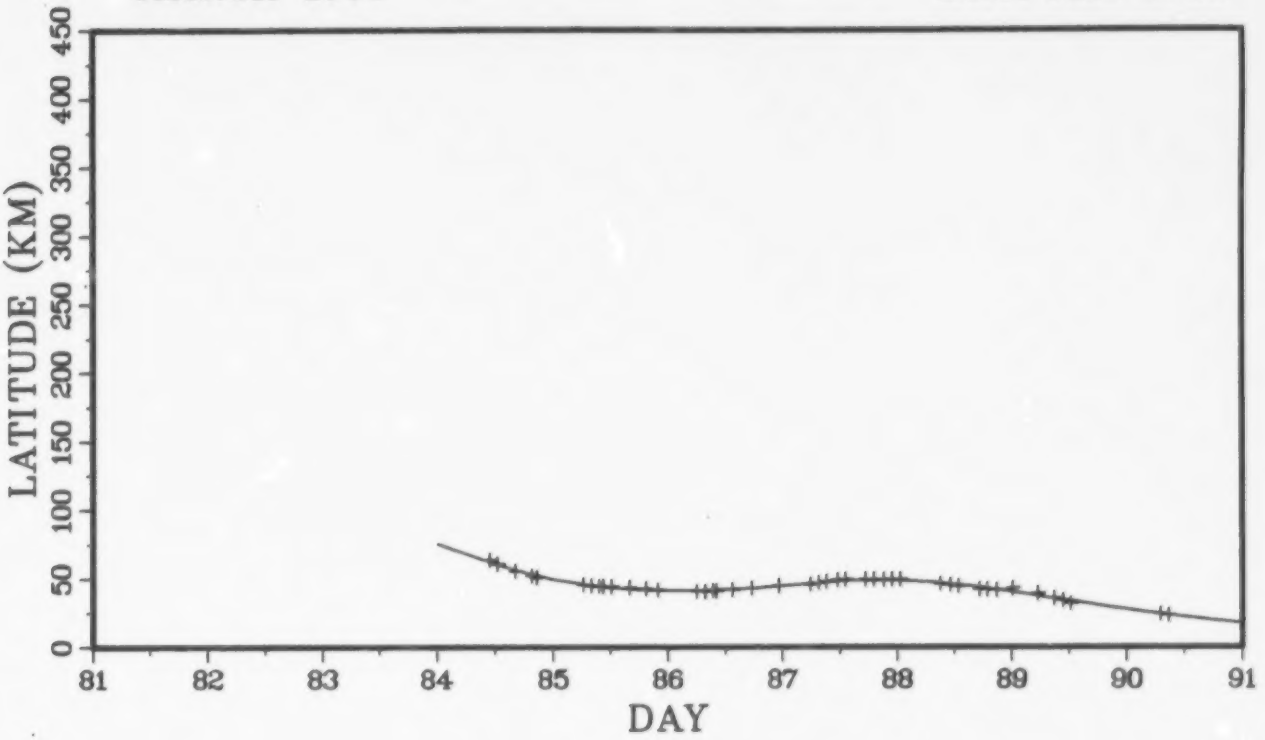


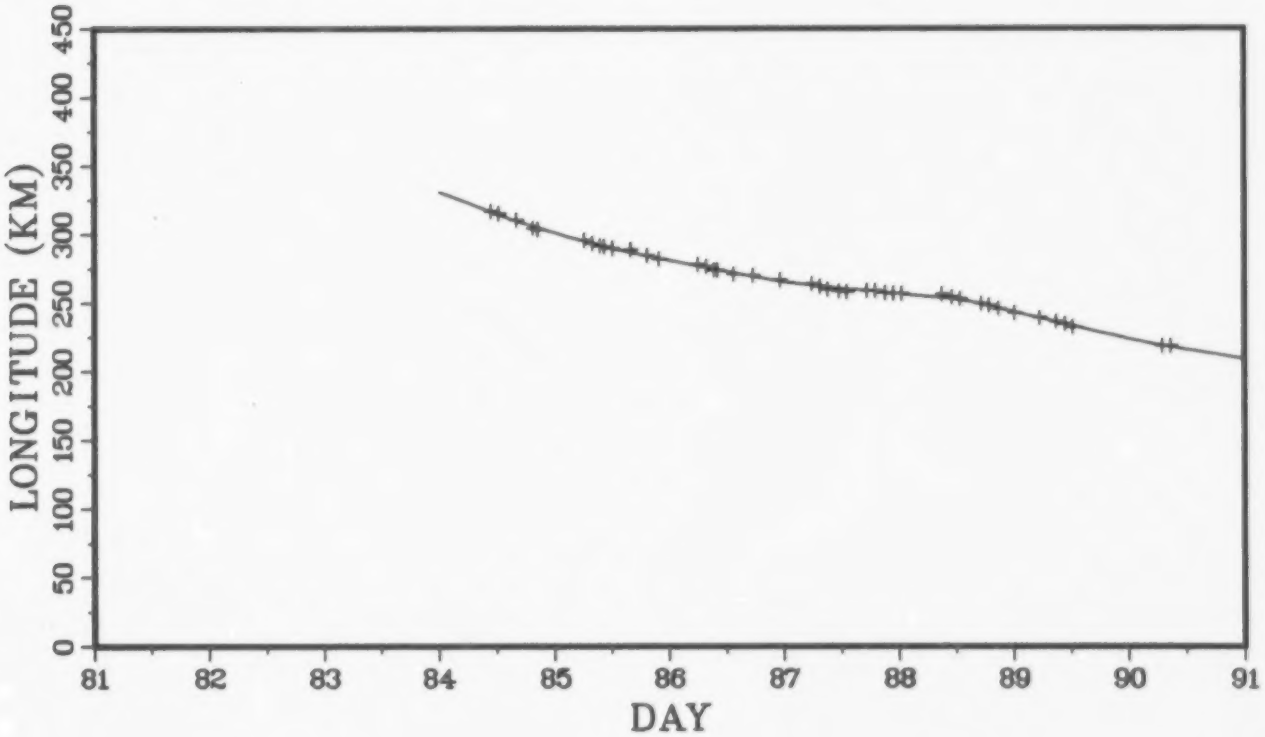
APRIL 1986 DRIFTER 2750



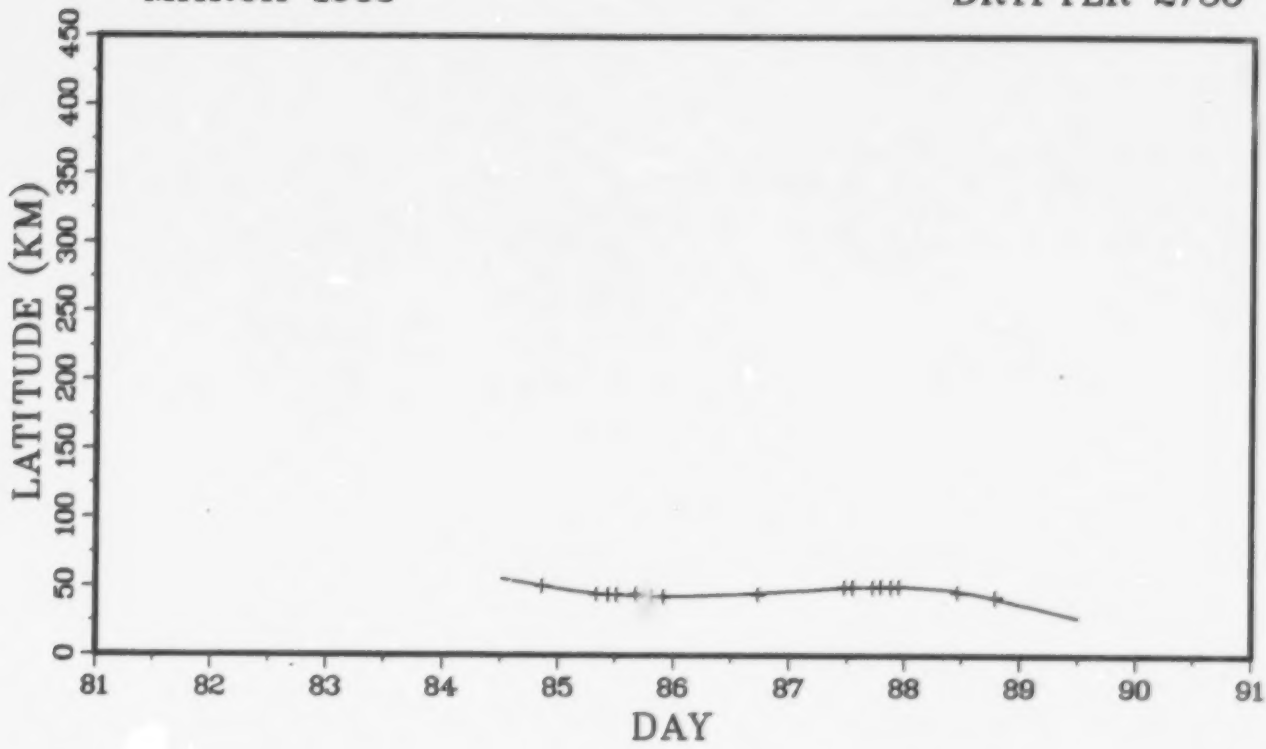


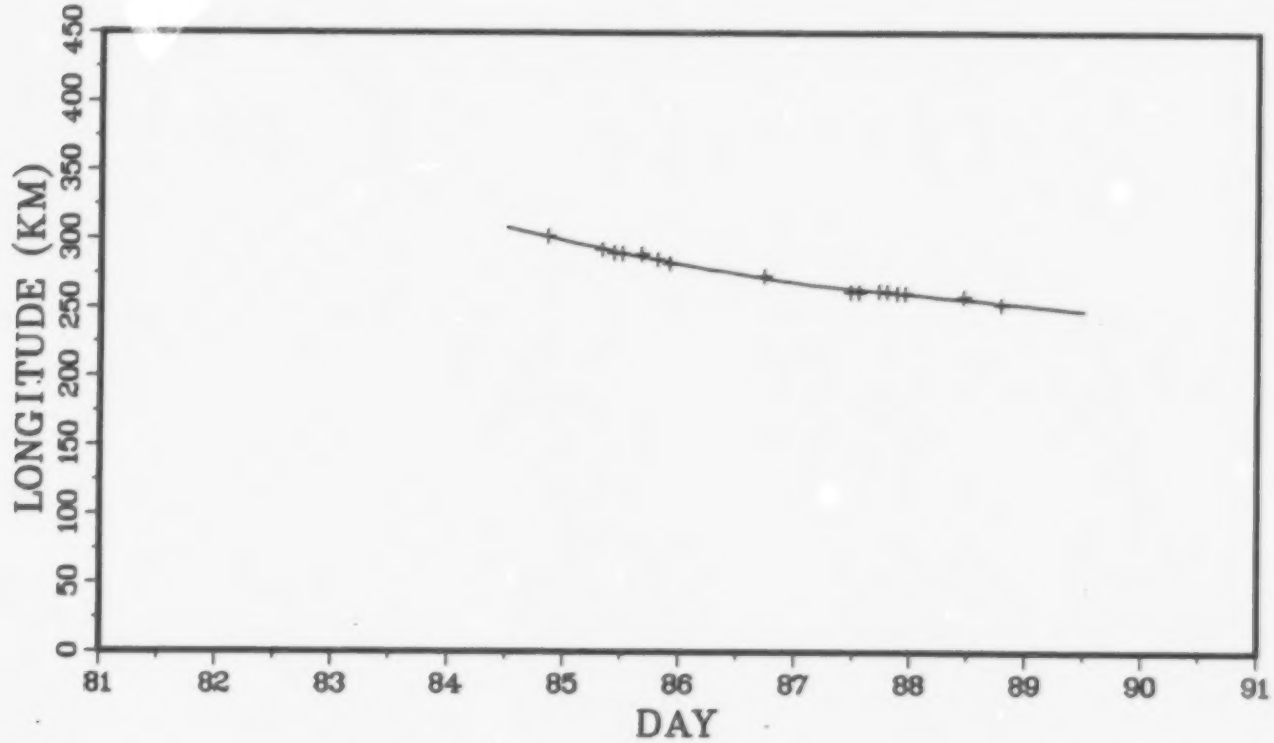
MARCH 1986 DRIFTER 2759



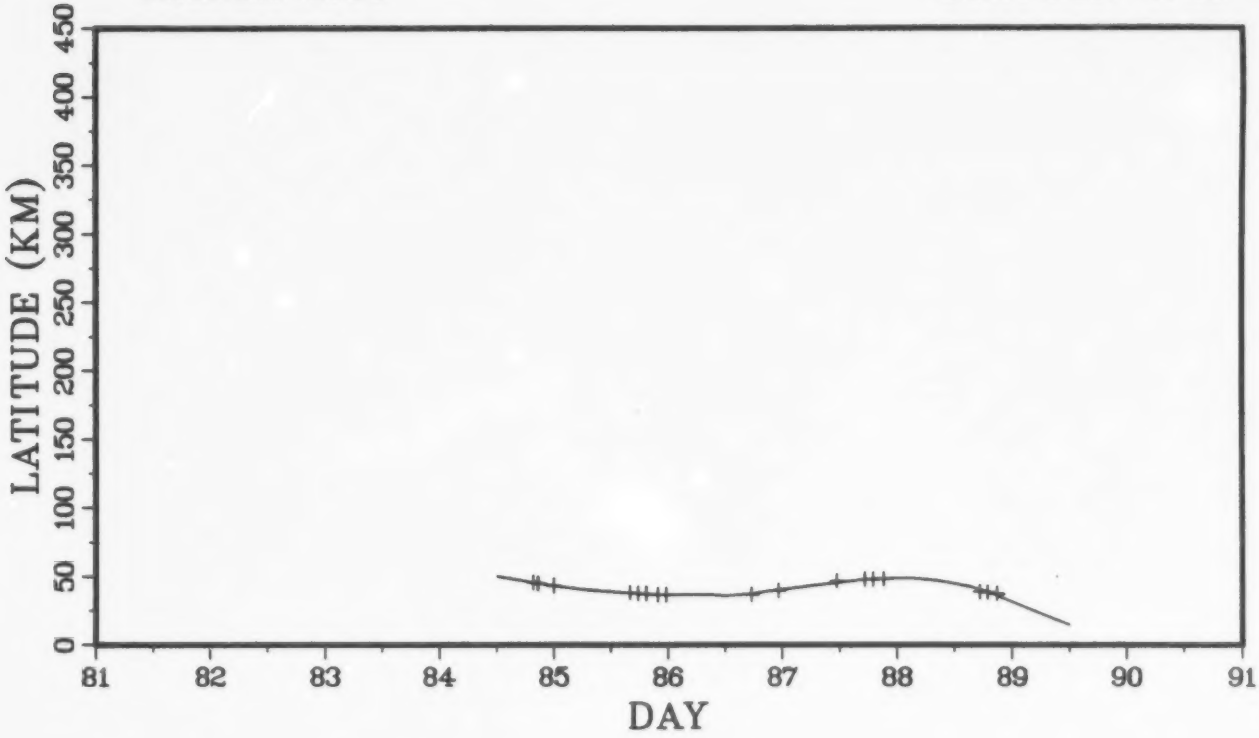


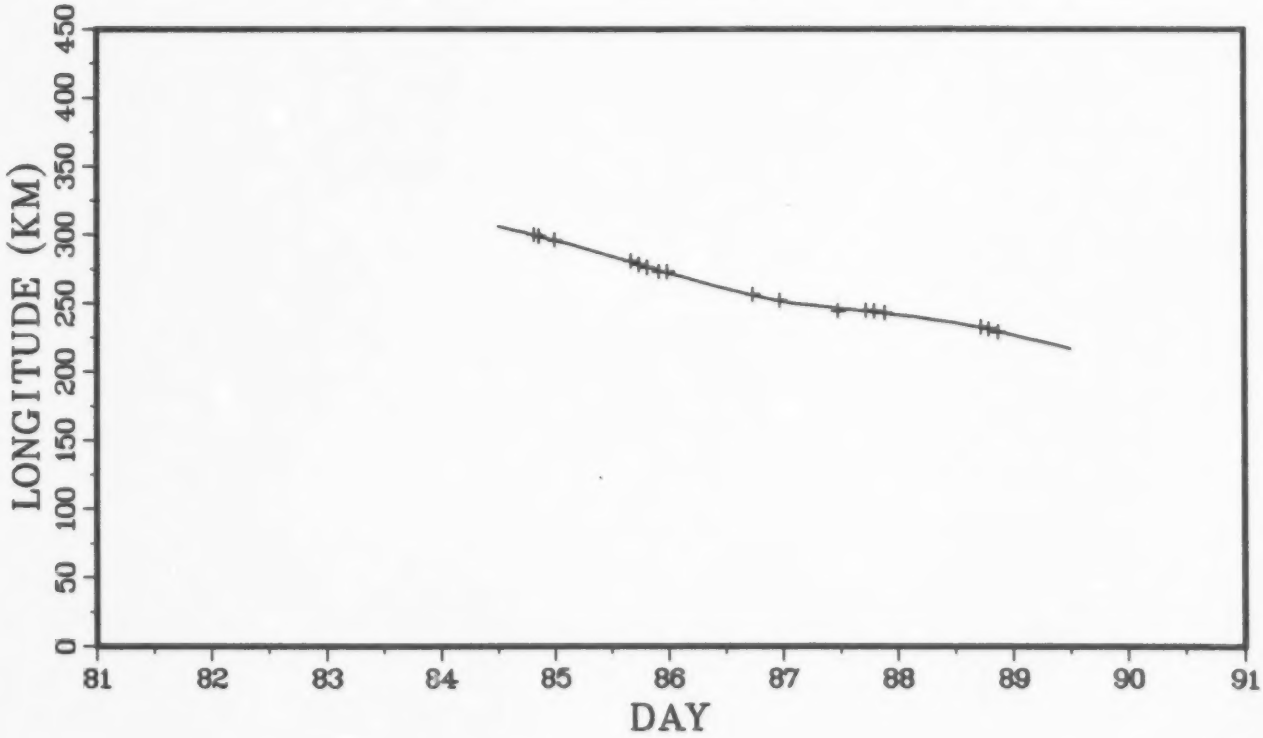
MARCH 1986 DRIFTER 2758

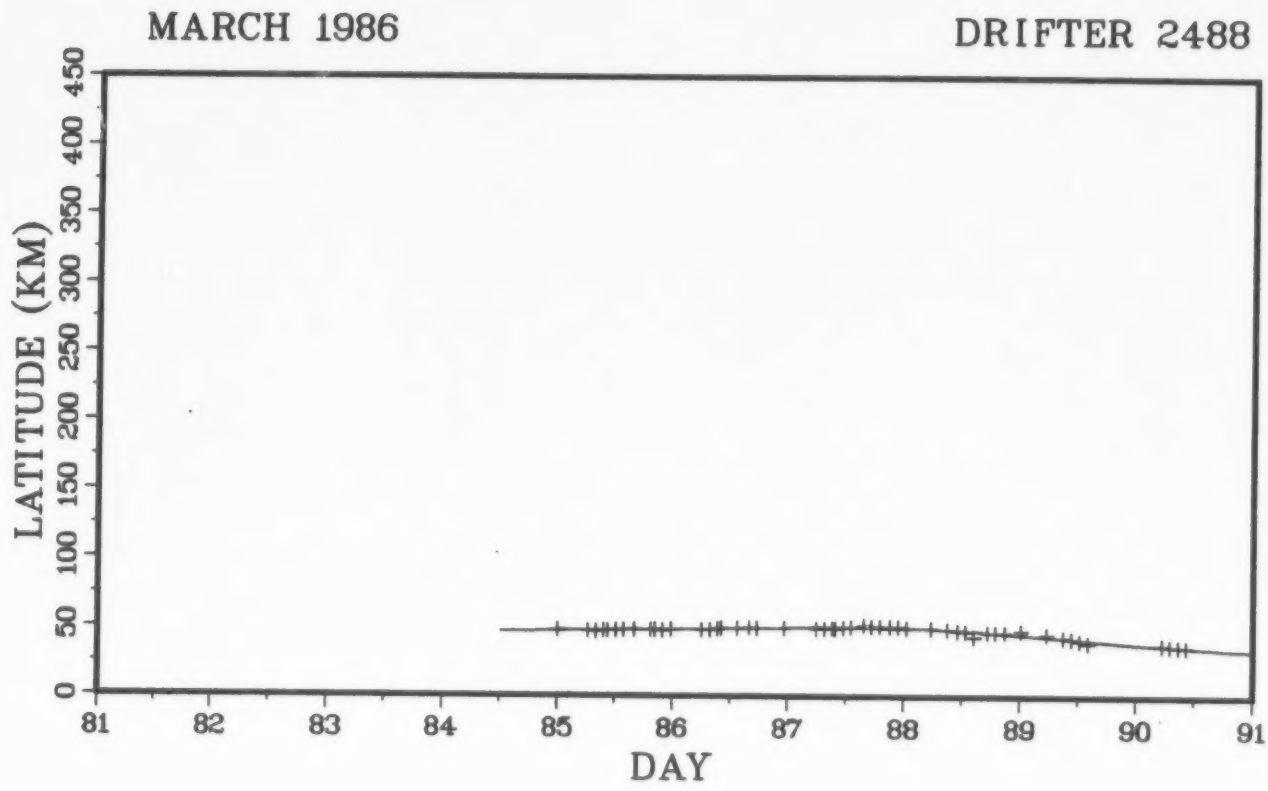


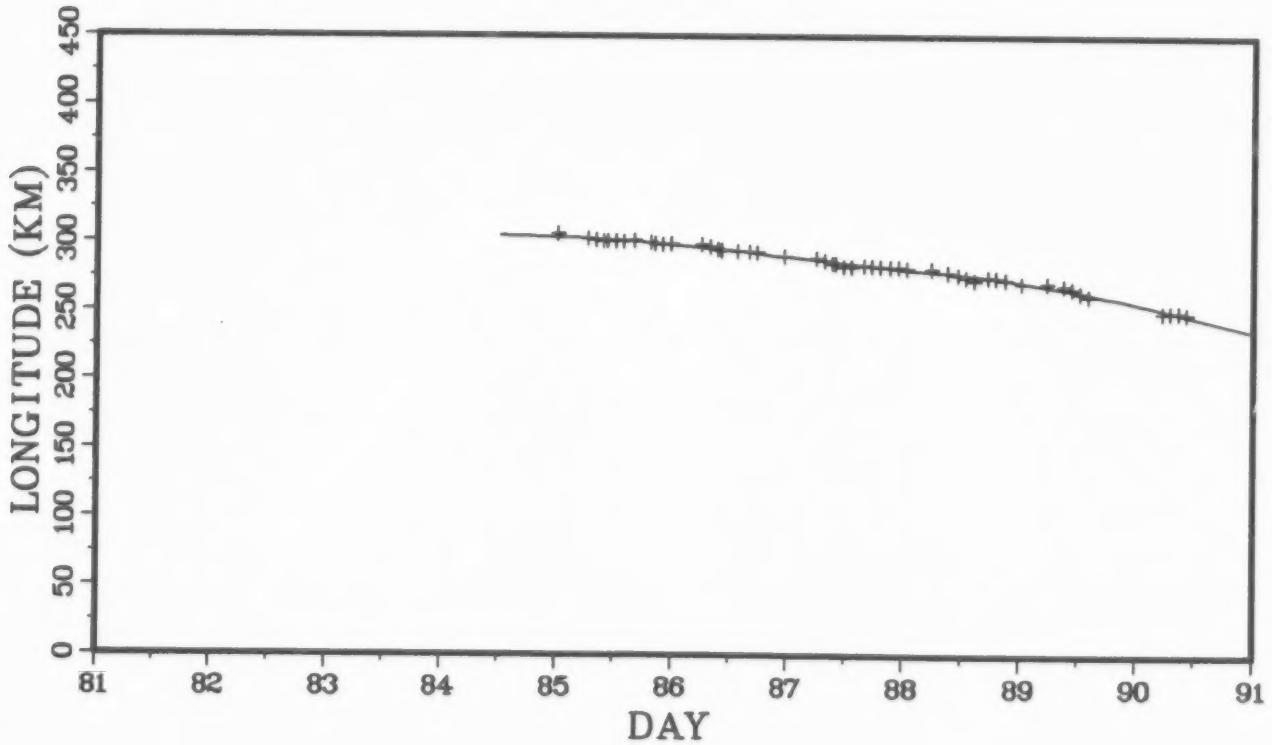


MARCH 1986 DRIFTER 2751

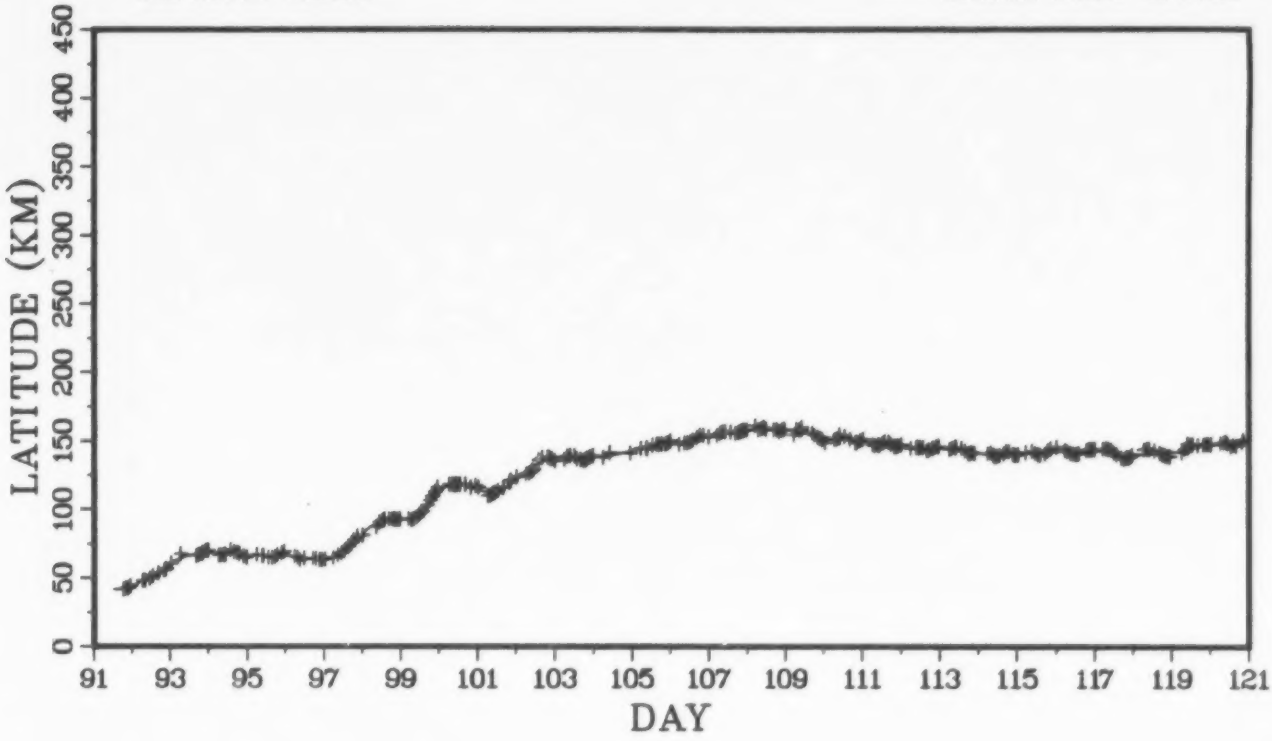


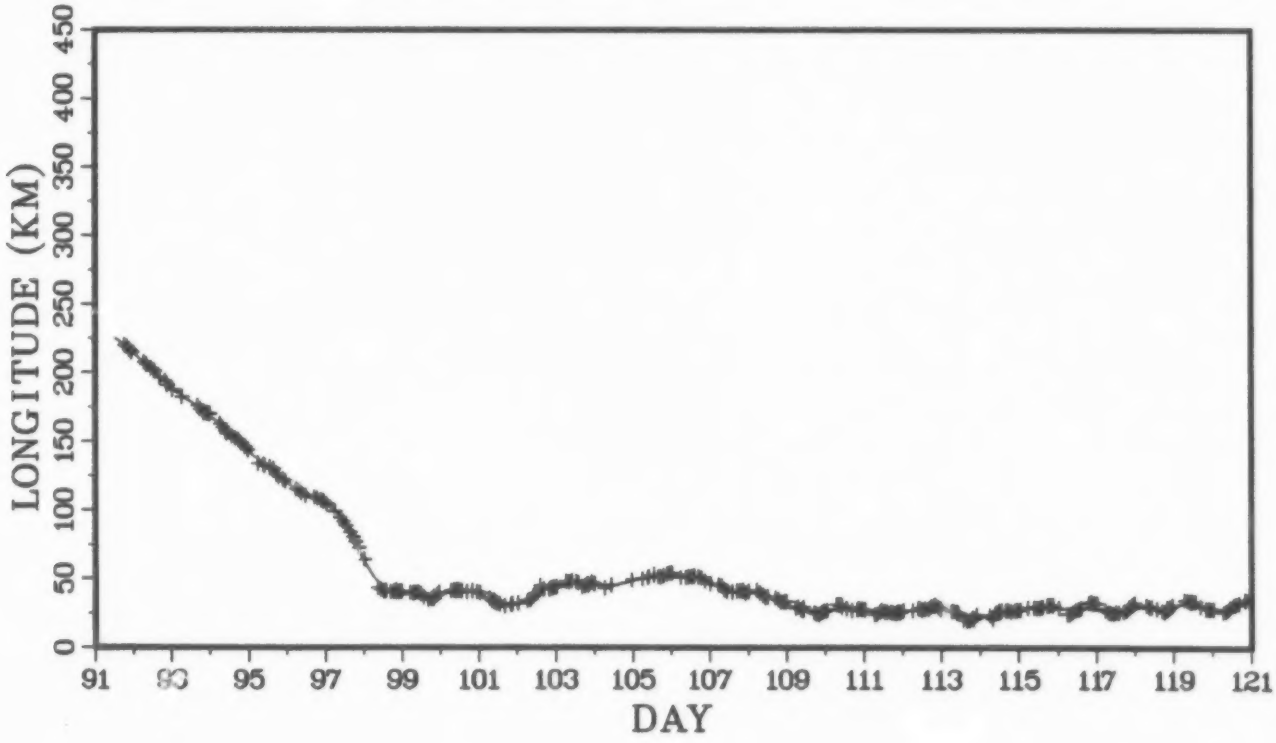



MARCH 1986
DRIFTER 2488
LATITUDE (KM)
0
50
100
150
200
250
300
350
400
450
81
82
83
84
85
86
87
88
89
90
91
DAY

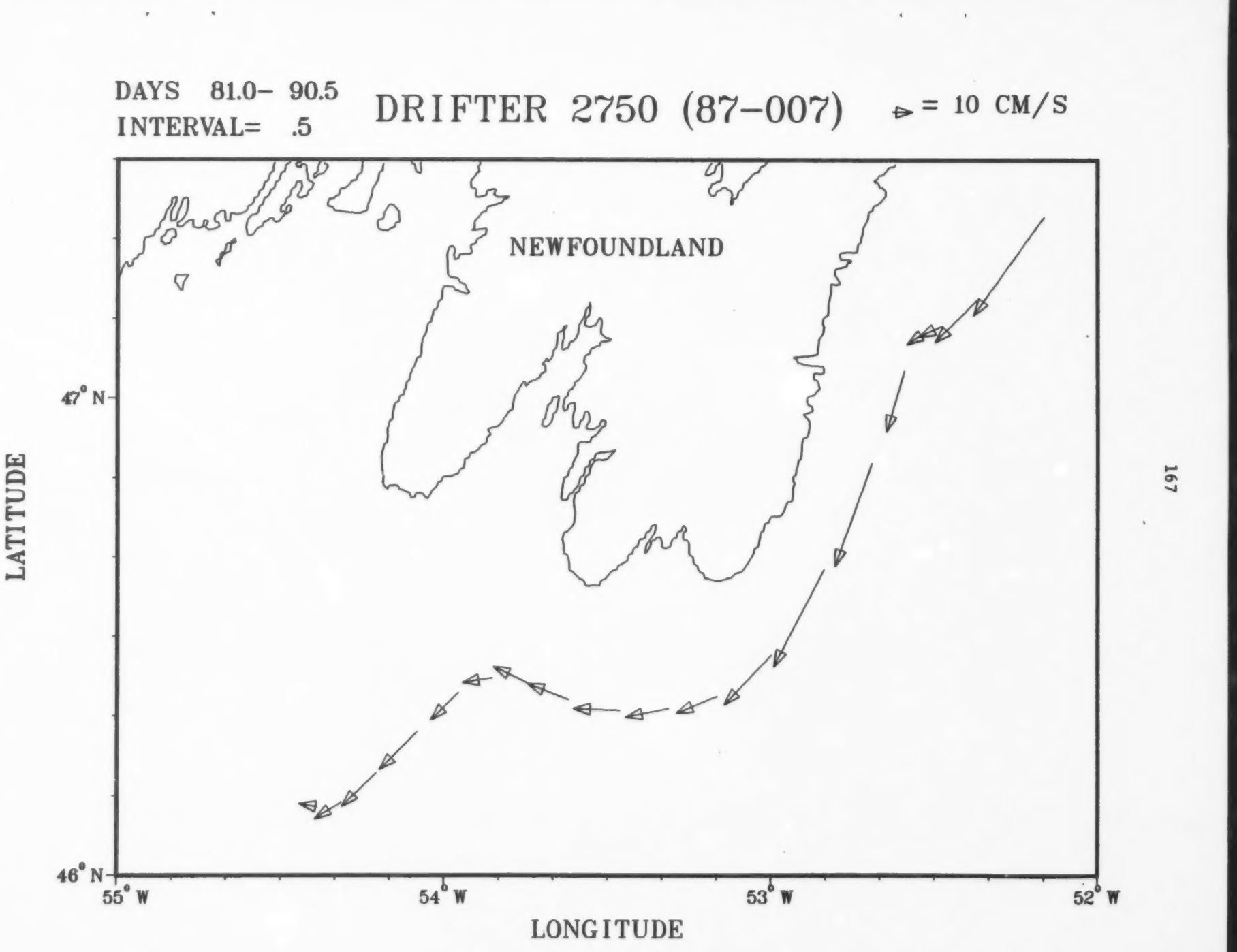

LONGITUDE (KM)
0
50
100
150
200
250
300
350
400
450
81
82
83
84
85
86
87
88
89
90
91
DAY

APRIL 1986 DRIFTER 2488





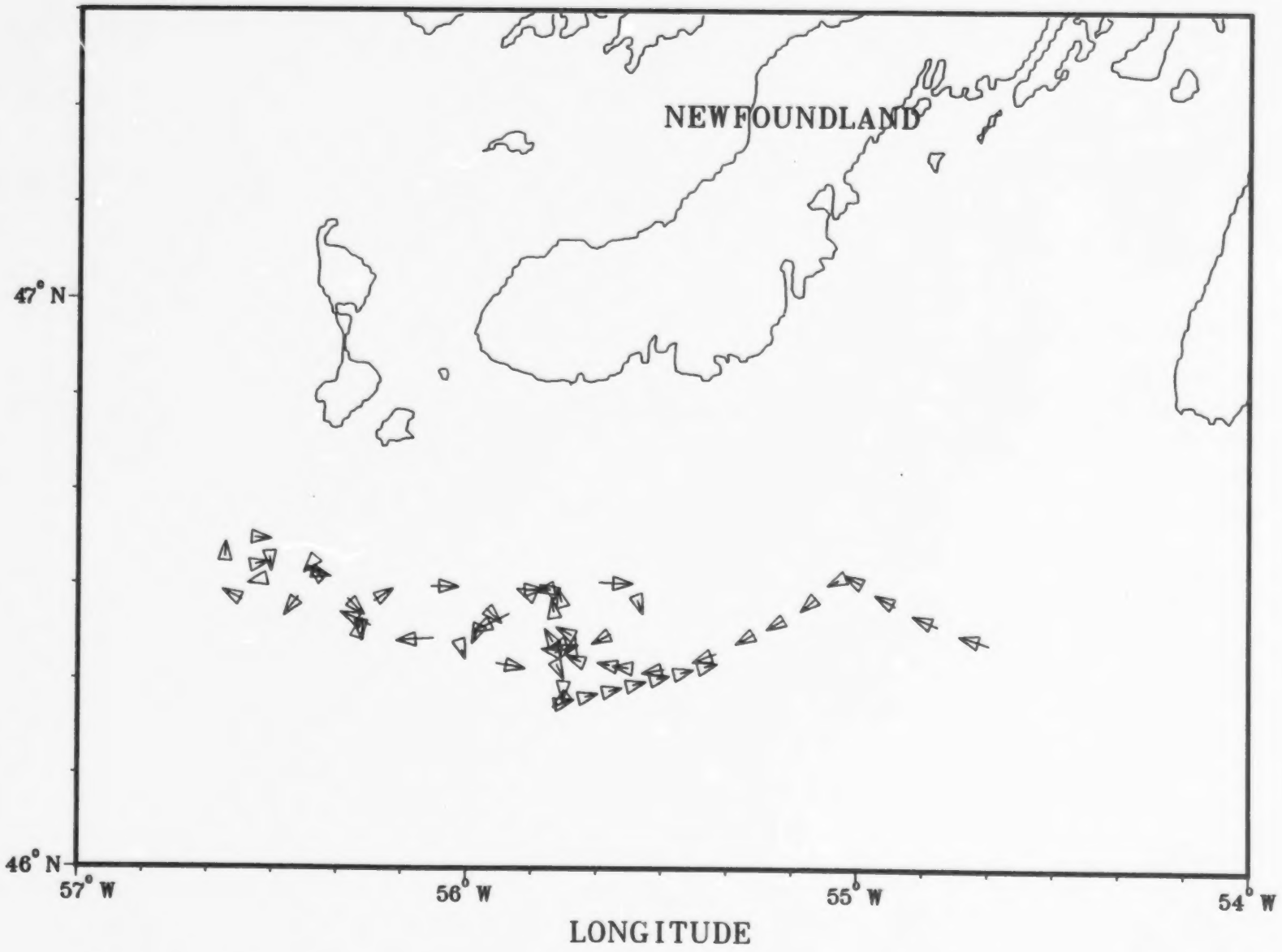
Succesive drifter velocities


DAYS 81.0- 90.5
INTERVAL= .5
DRIFTER 2750 (87-007)
= 10 CM/S
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

DAYS 91.0–121.0
INTERVAL= .5

DRIFTER 2750 (87–007)

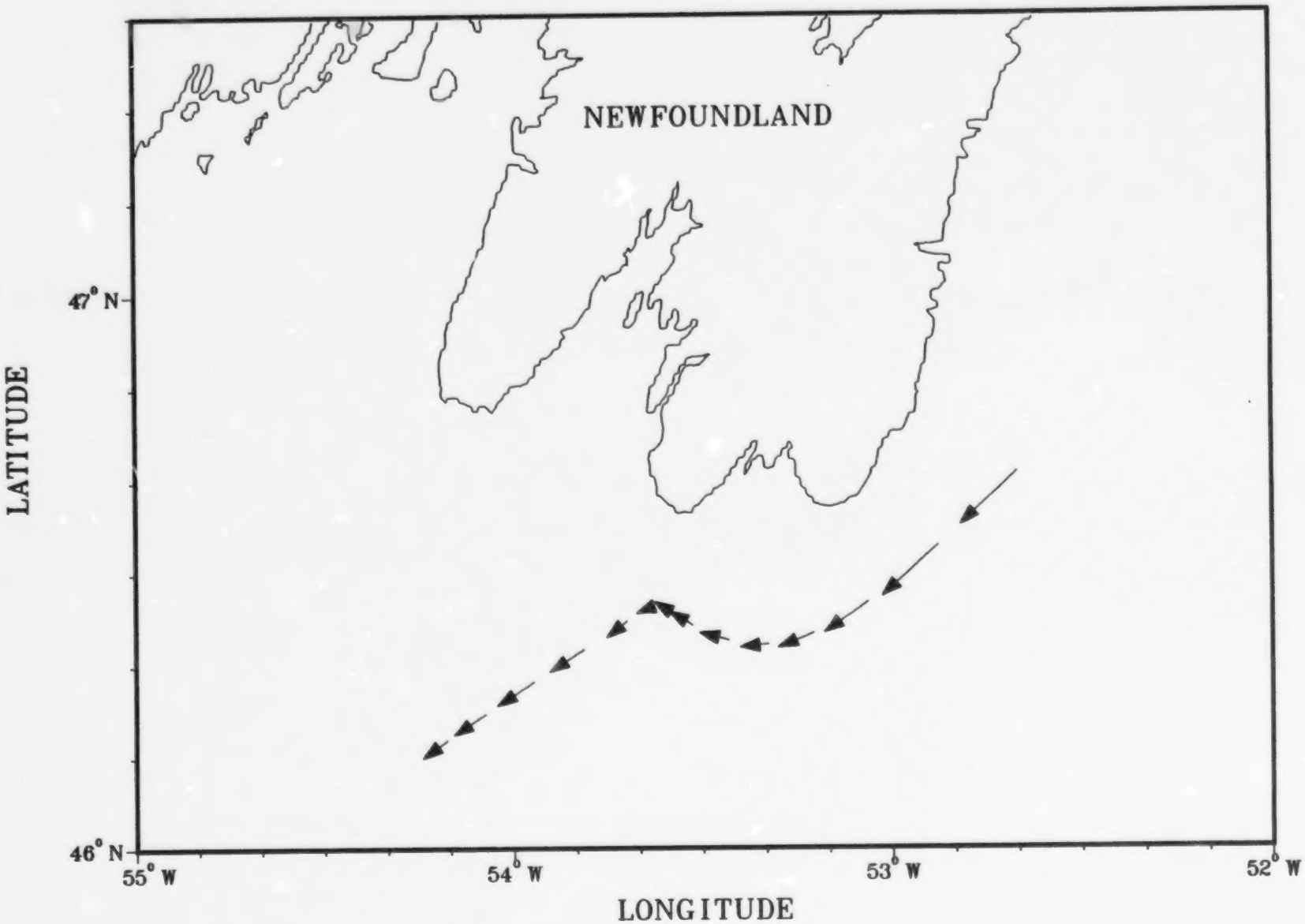
> = 10 CM/S



DAYS 84.0- 90.5
INTERVAL= .5

DRIFTER 2759 (87-007)

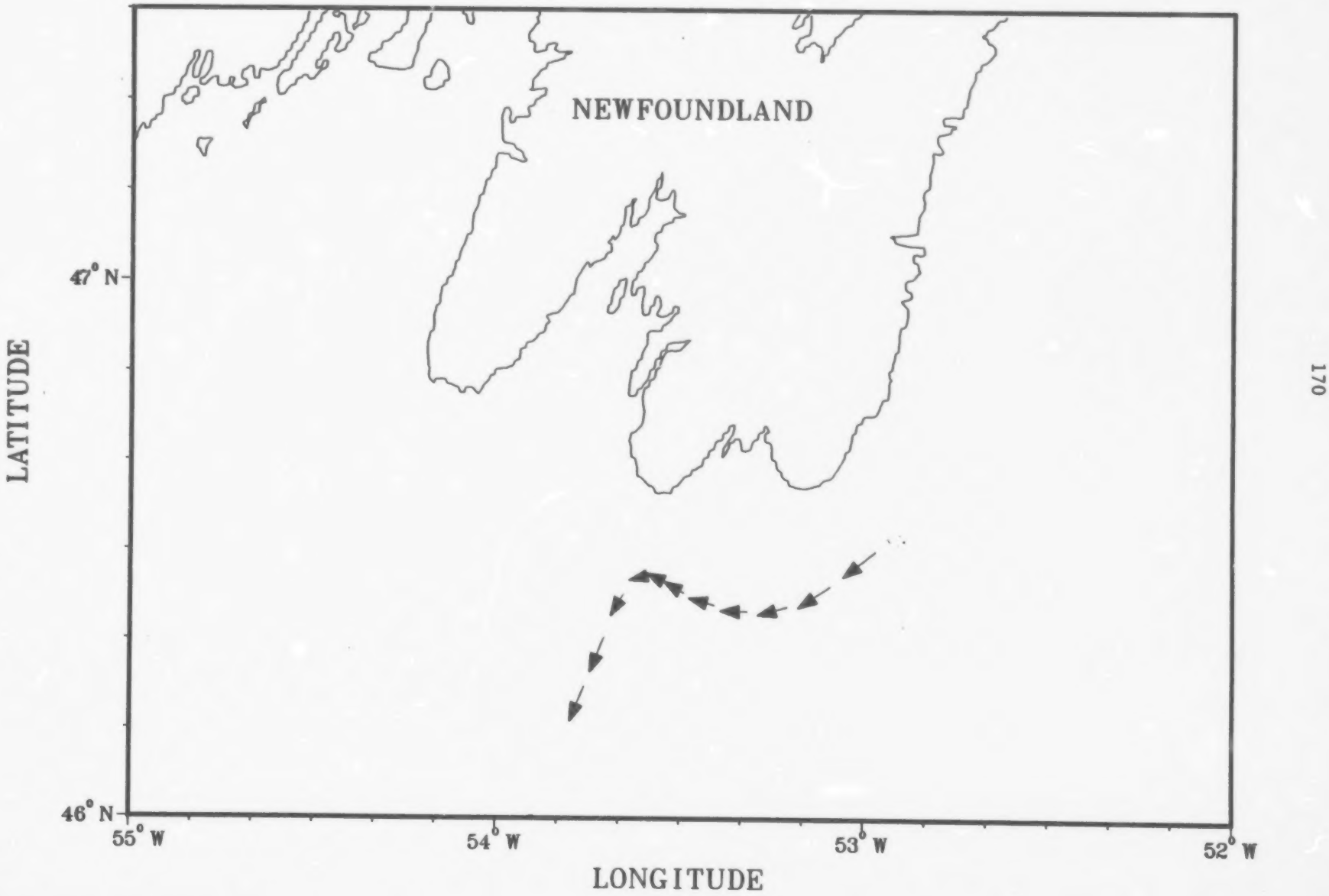
► = 10 CM/S



DAYS 84.5– 89.5
INTERVAL= .5

DRIFTER 2758 (87–007)

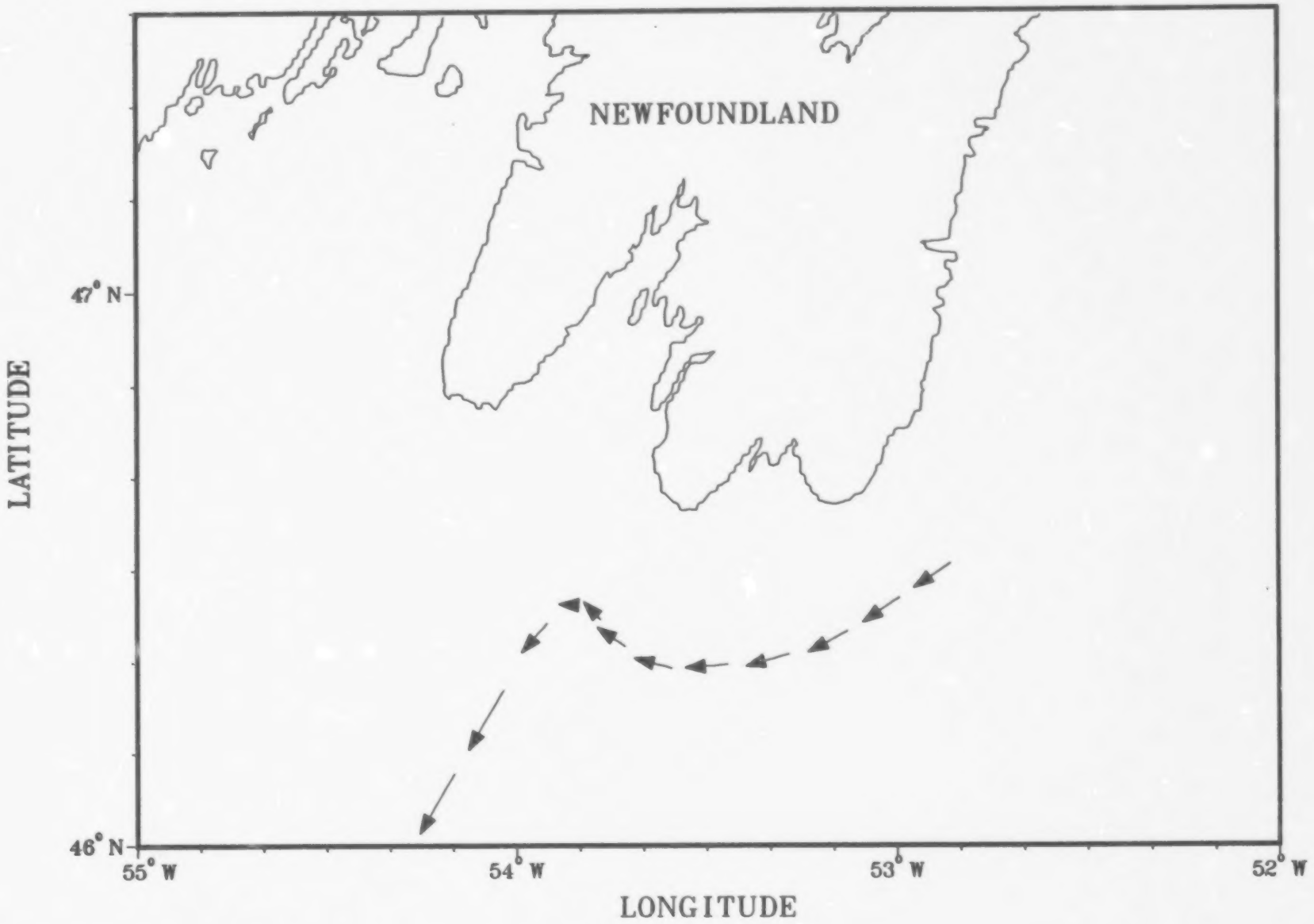
► = 10 CM/S



DAYS 84.0- 89.5
INTERVAL= .5

DRIFTER 2751 (87-007)

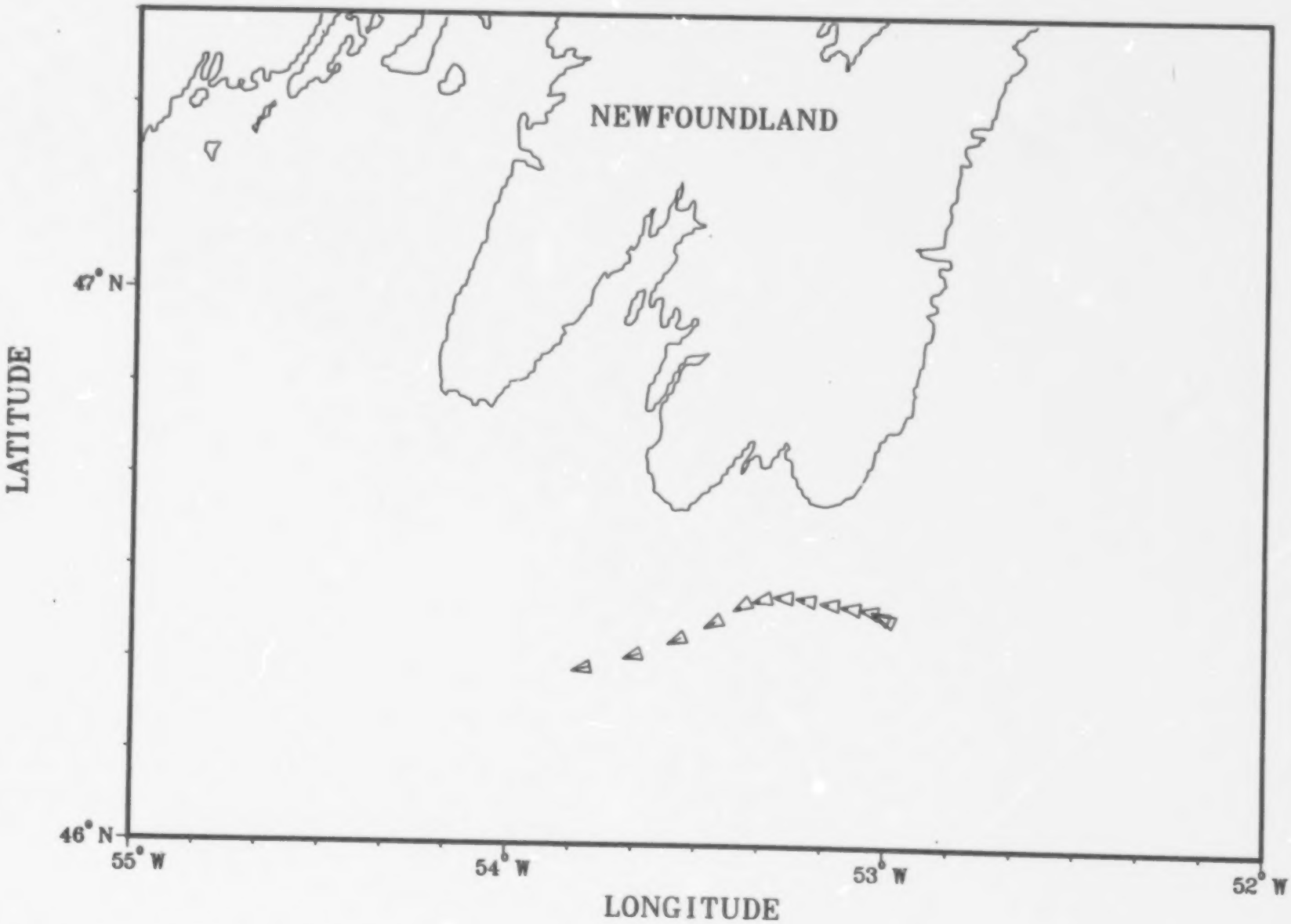
► = 10 CM/S



DAYS 84.5– 90.5
INTERVAL= .5

DRIFTER 2488 (87–007)

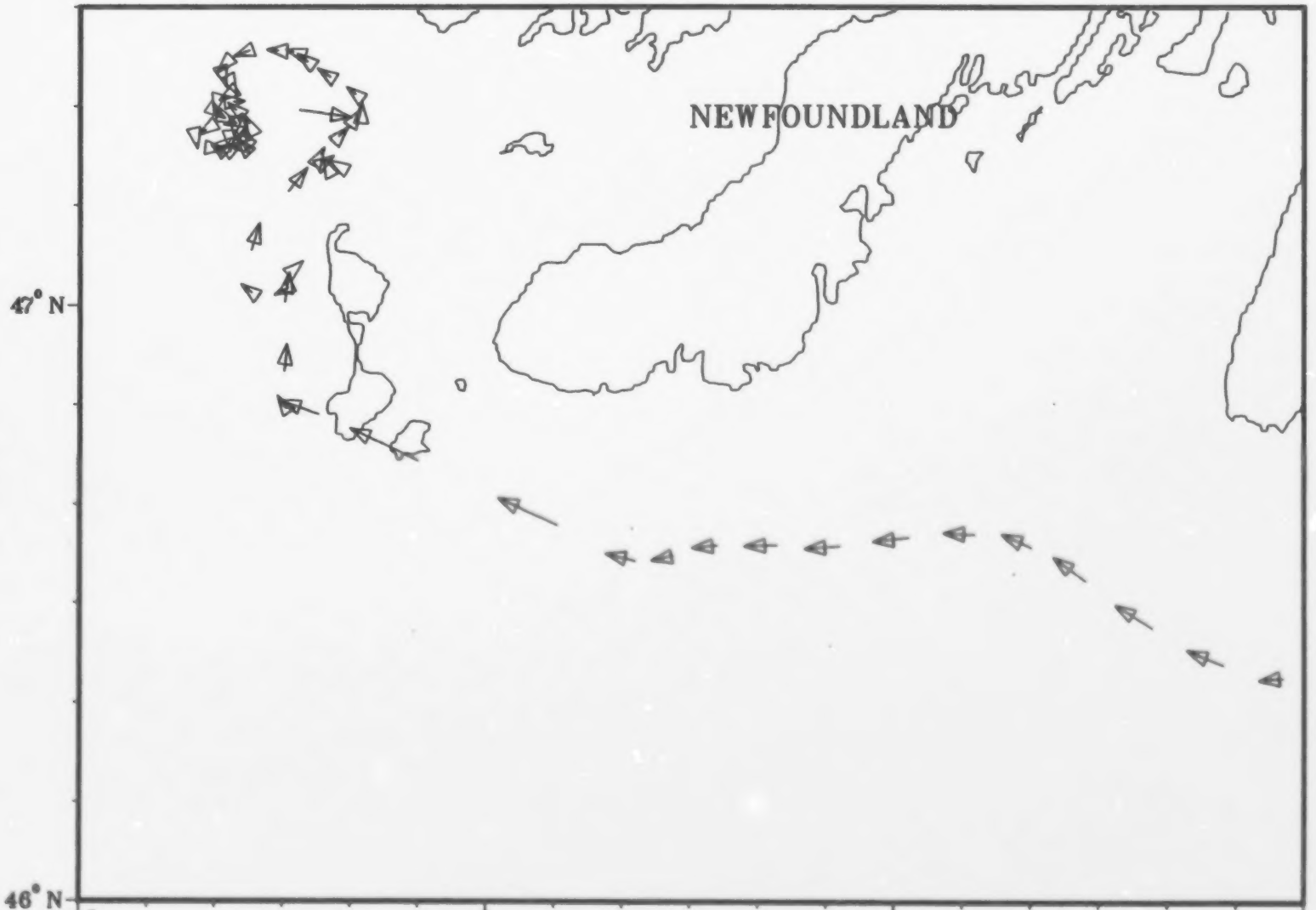
> = 10 CM/S



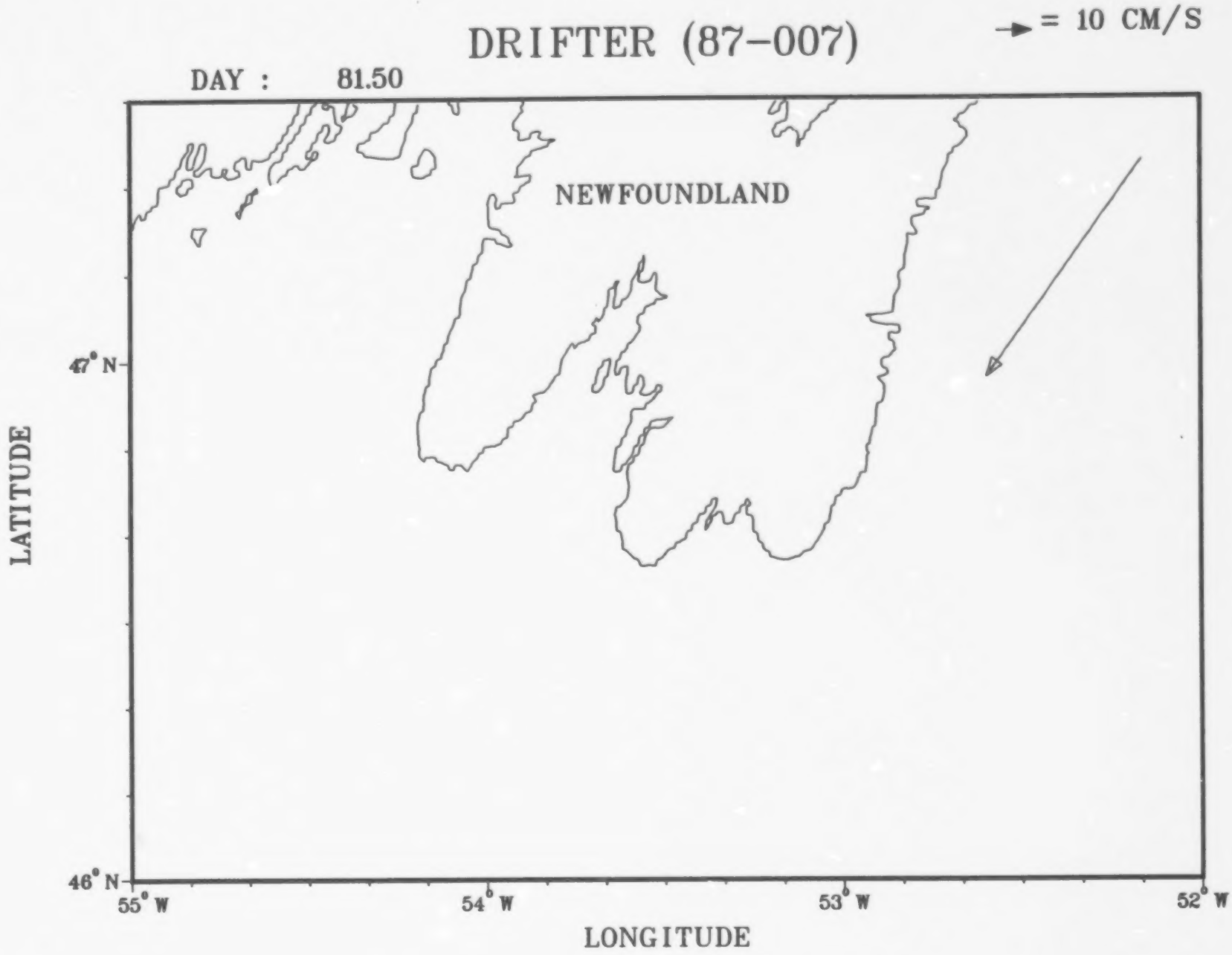
DAYS 91.0–121.0
INTERVAL= .5

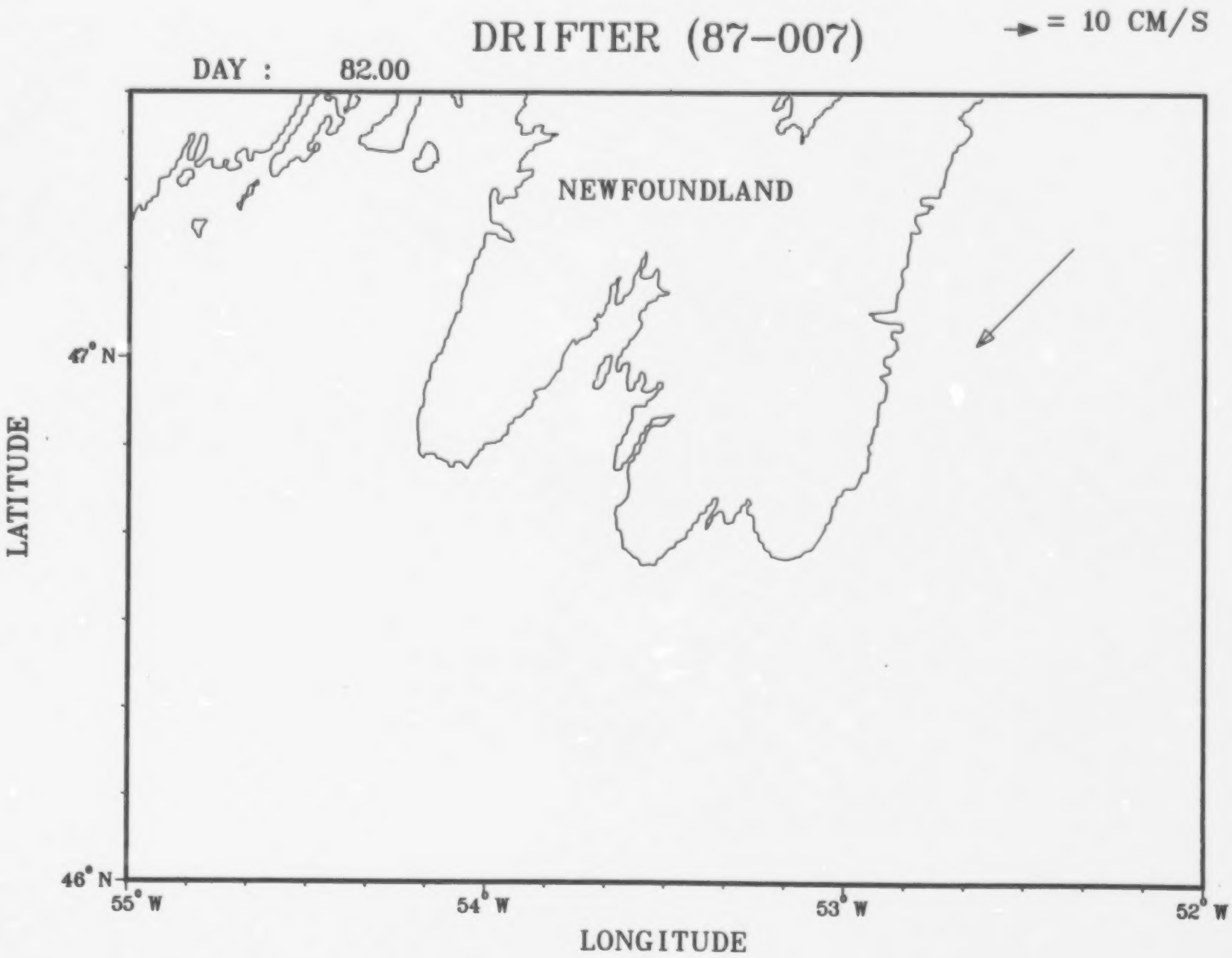
DRIFTER 2488 (87–007)

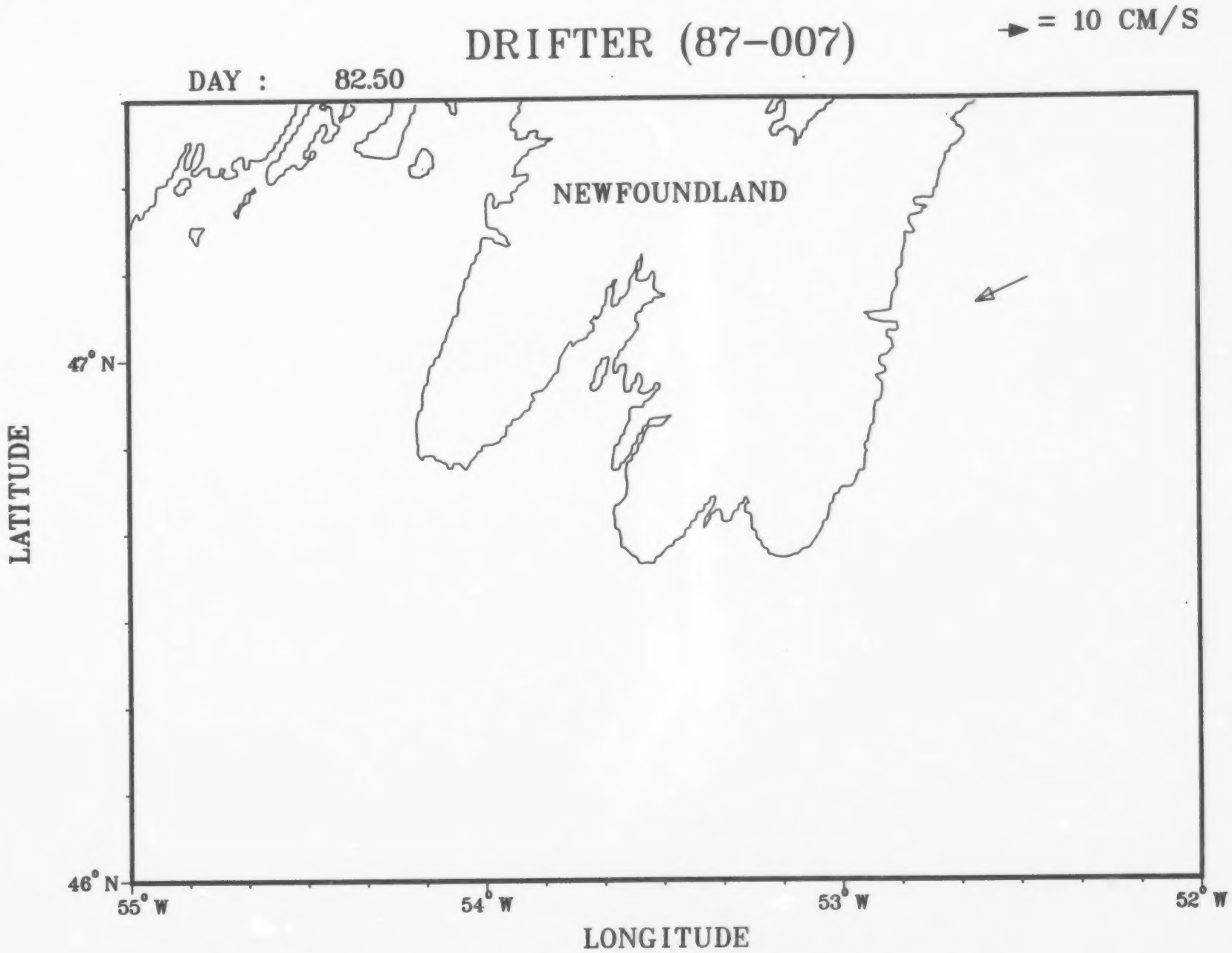
▻ = 10 CM/S

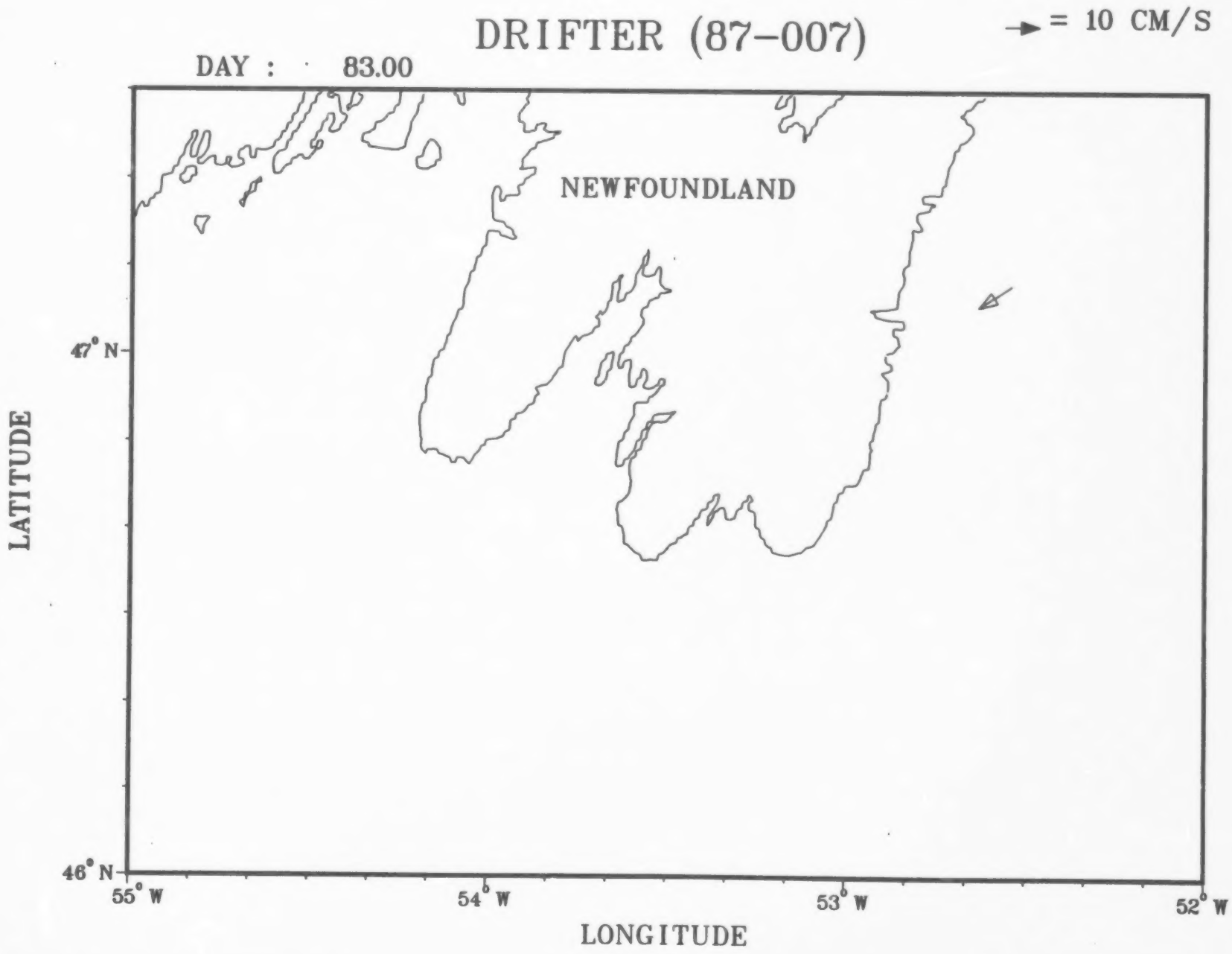


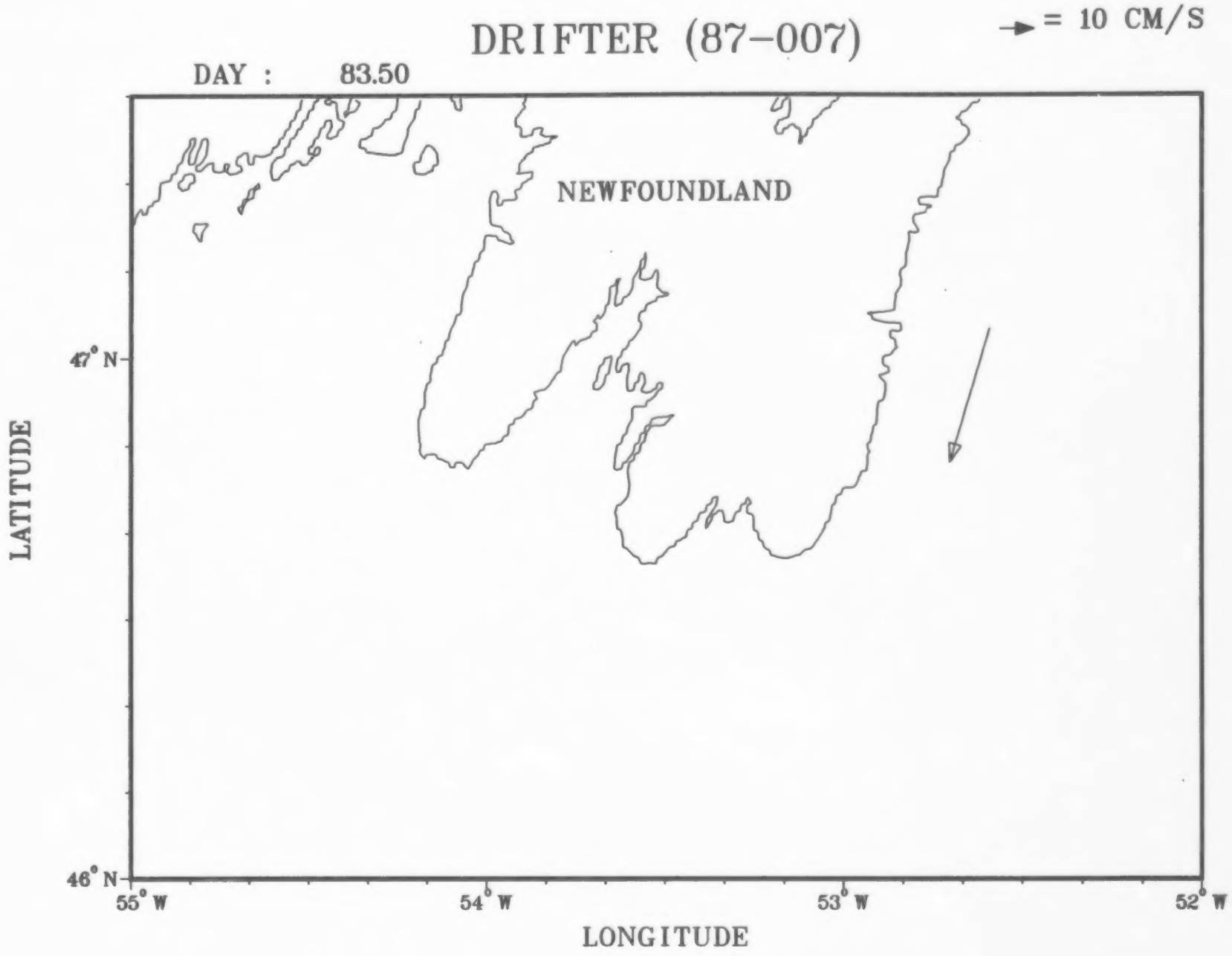
Drifter veclocities at given times

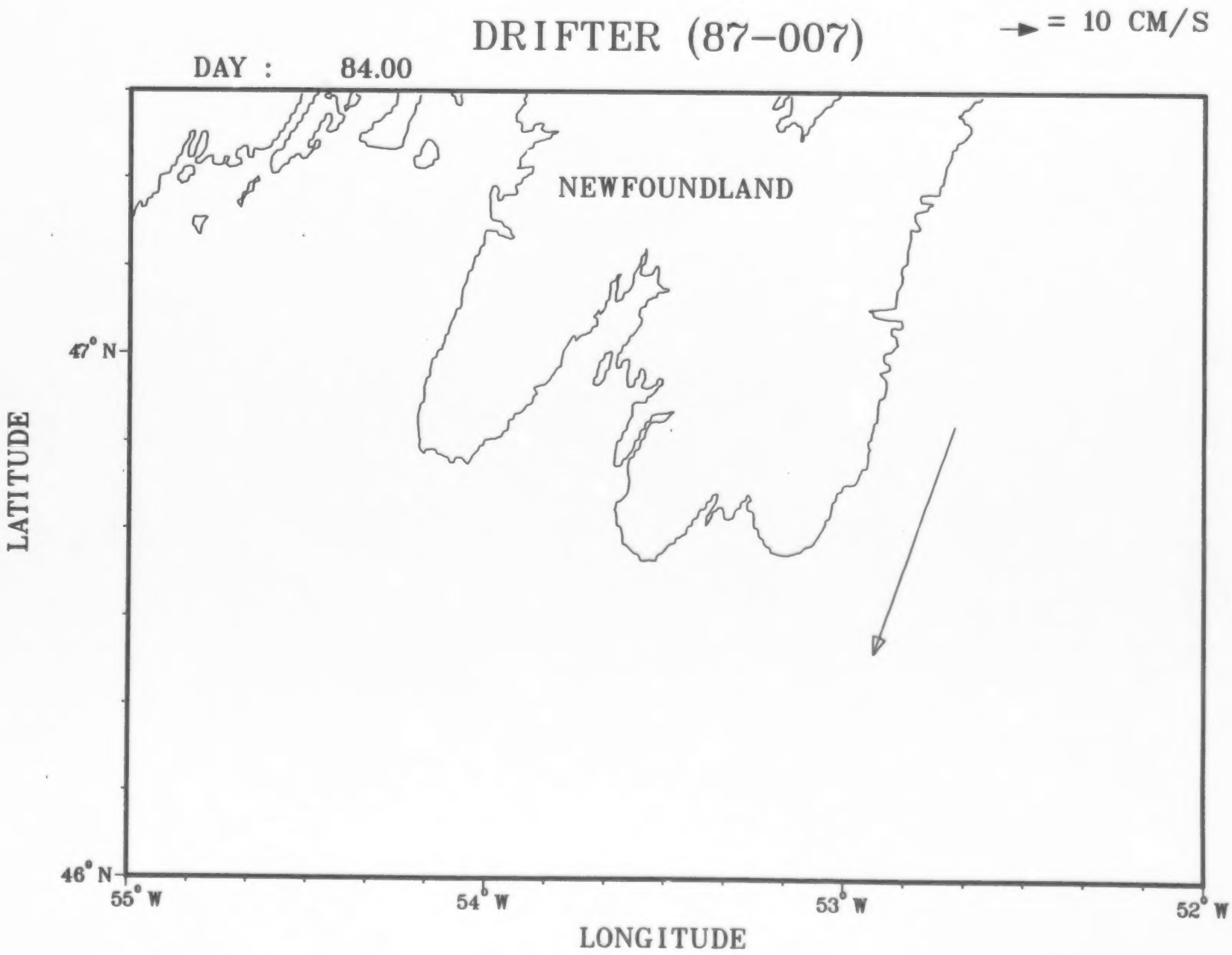

DRIFTER (87-007)
= 10 CM/S
DAY : 81.50
NEWFOUNDLAND
47° N
46° N
LATITUDE
55° W
54° W
53° W
52° W
LONGITUDE

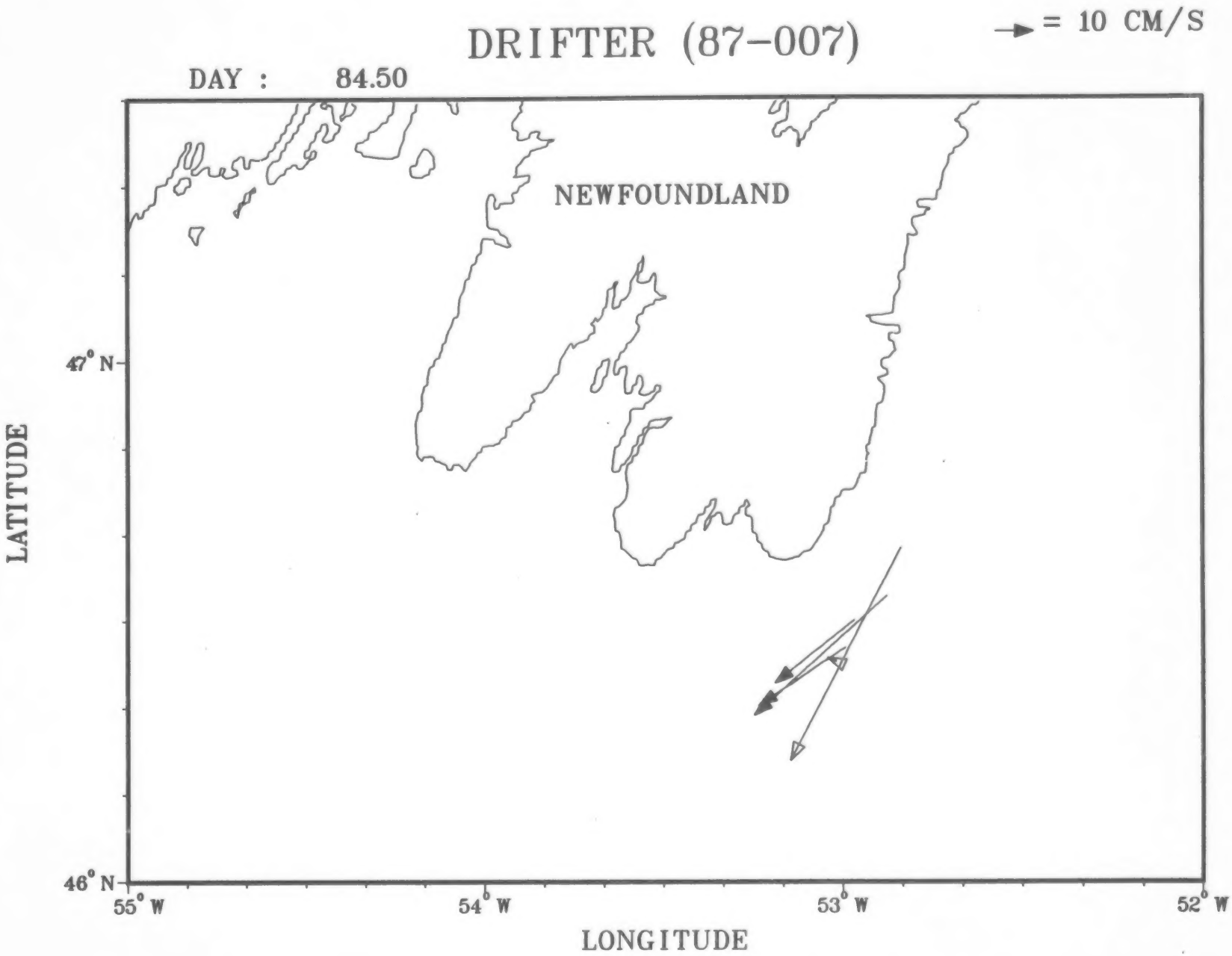

DRIFTER (87-007)
→ = 10 CM/S
DAY : 82.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

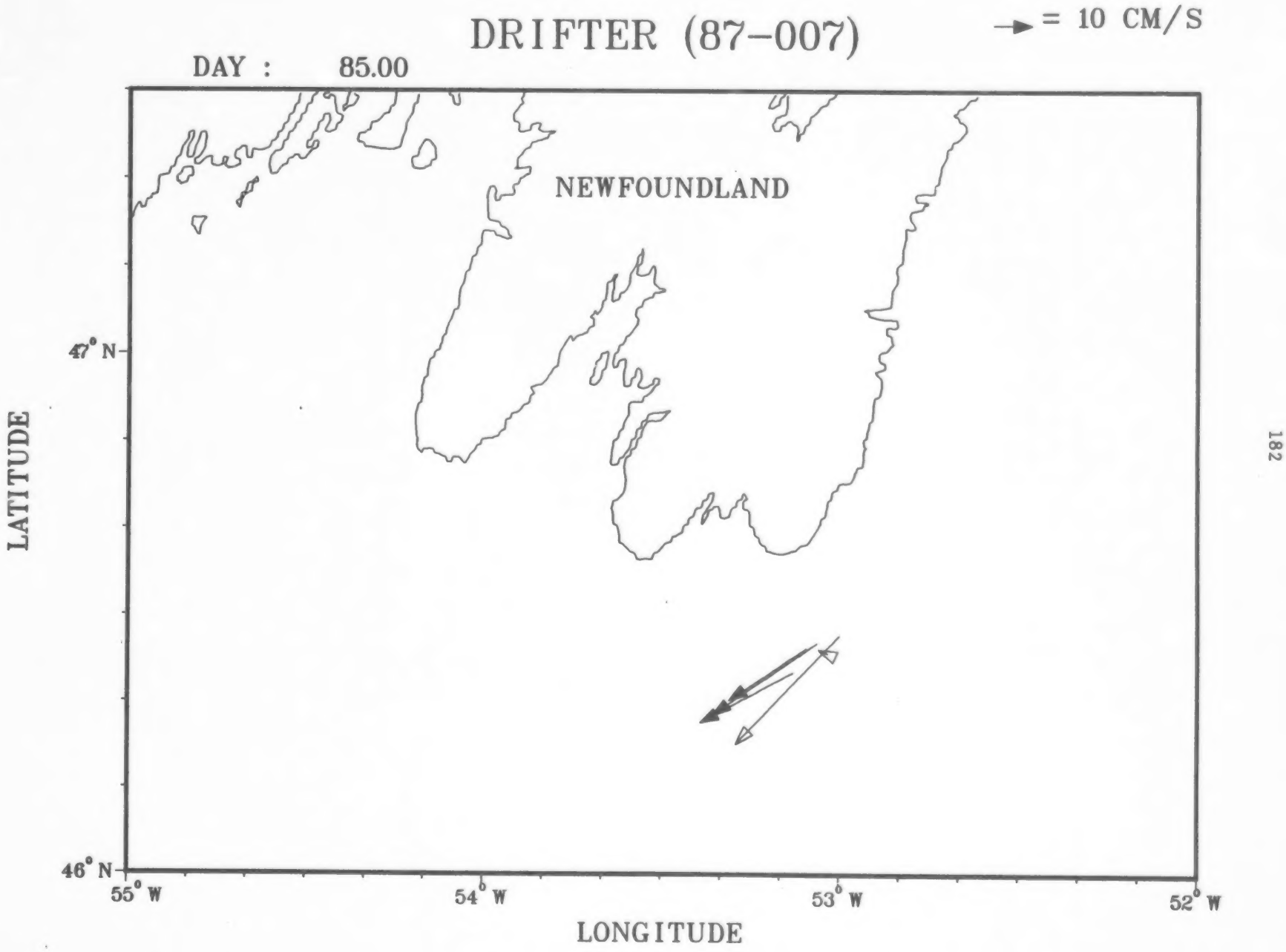

DRIFTER (87–007)
= 10 CM/S
DAY : 82.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE


DRIFTER (87-007)
= 10 CM/S
DAY : 83.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

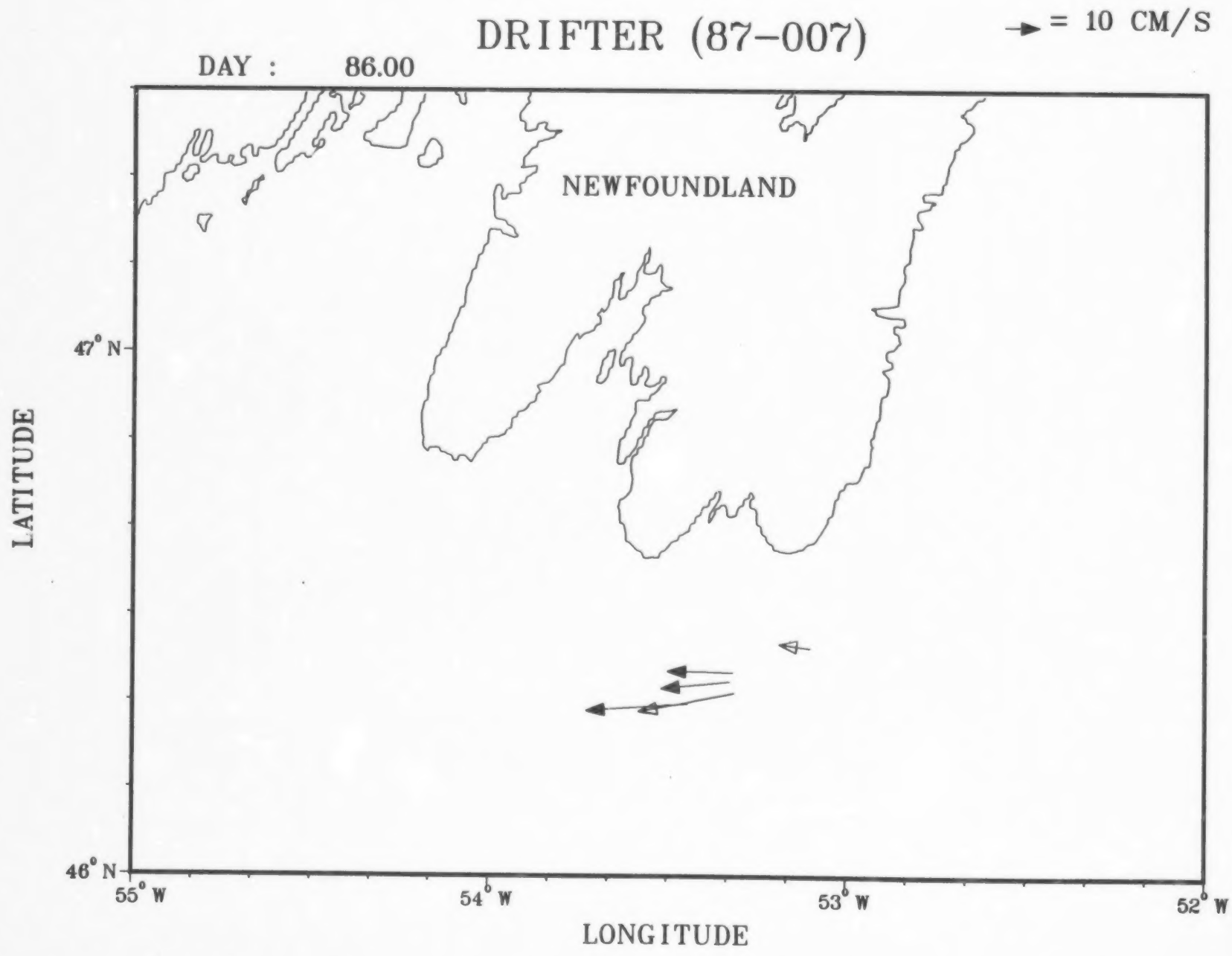

DRIFTER (87-007)
= 10 CM/S
DAY : 83.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

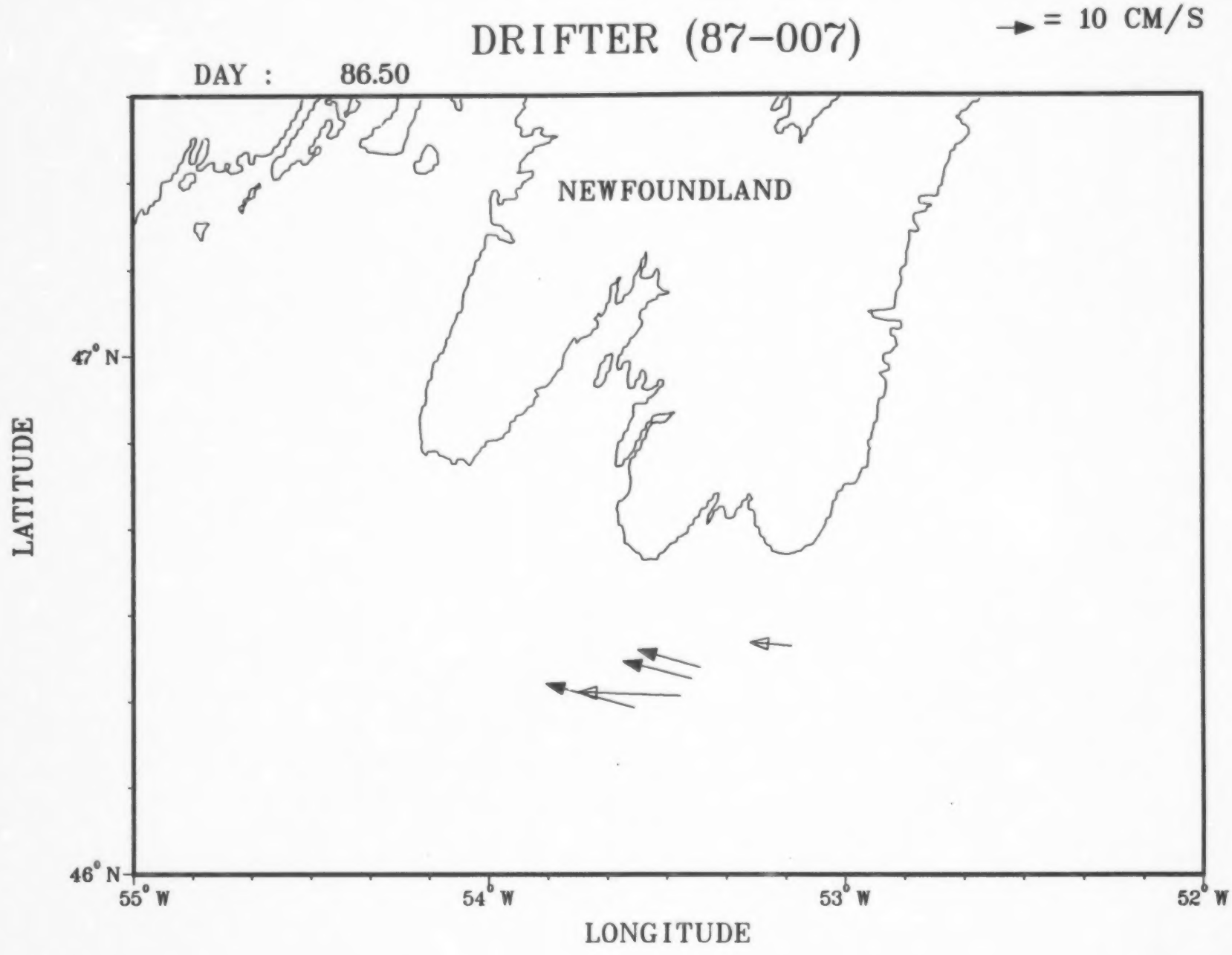

DRIFTER (87-007)
→ = 10 CM/S
DAY : 84.00
NEWFOUNDLAND
47° N
46° N
LATITUDE
55° W
54° W
53° W
52° W
LONGITUDE

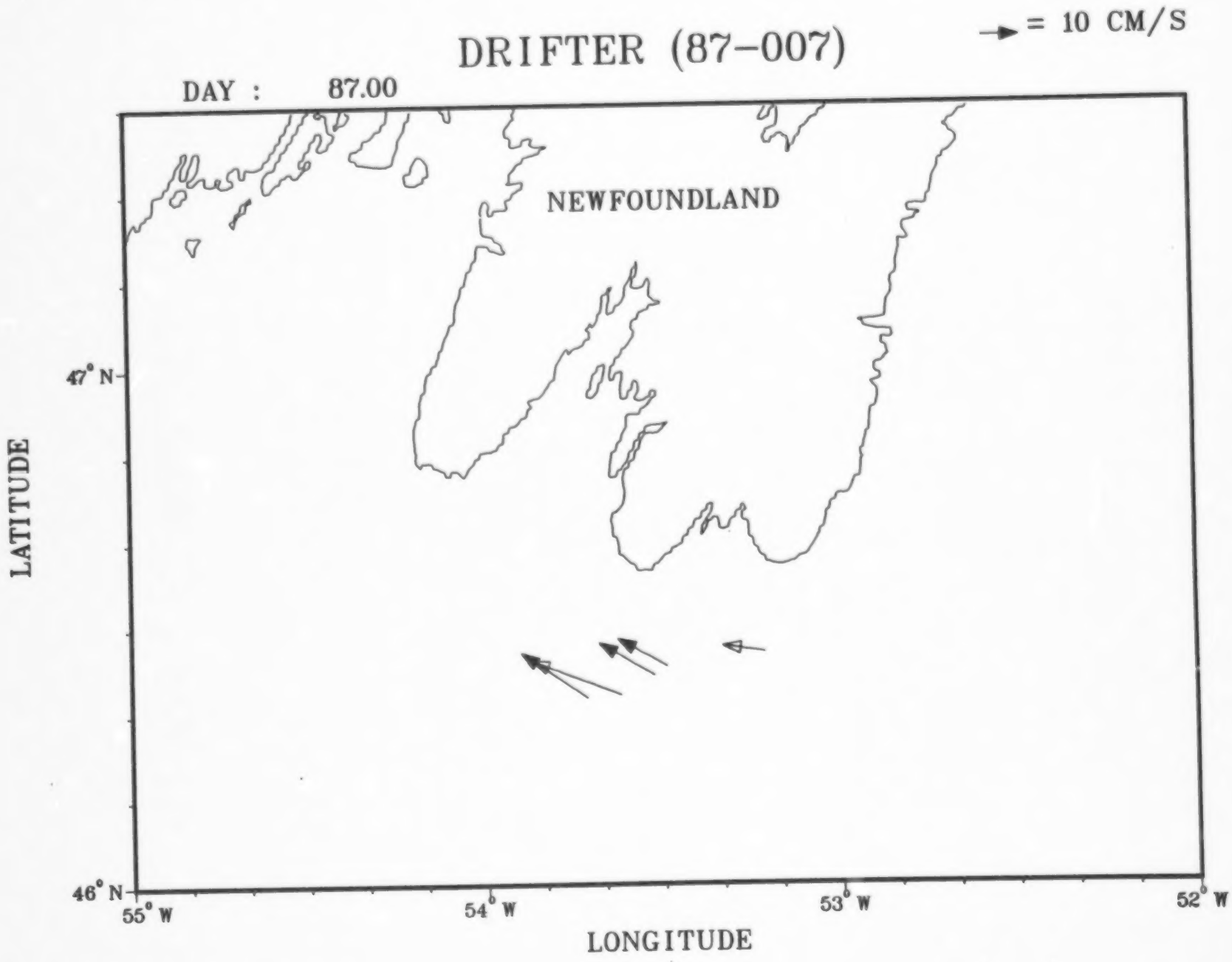

DRIFTER (87-007)
→ = 10 CM/S
DAY : 84.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE


DRIFTER (87-007)
= 10 CM/S
DAY : 85.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

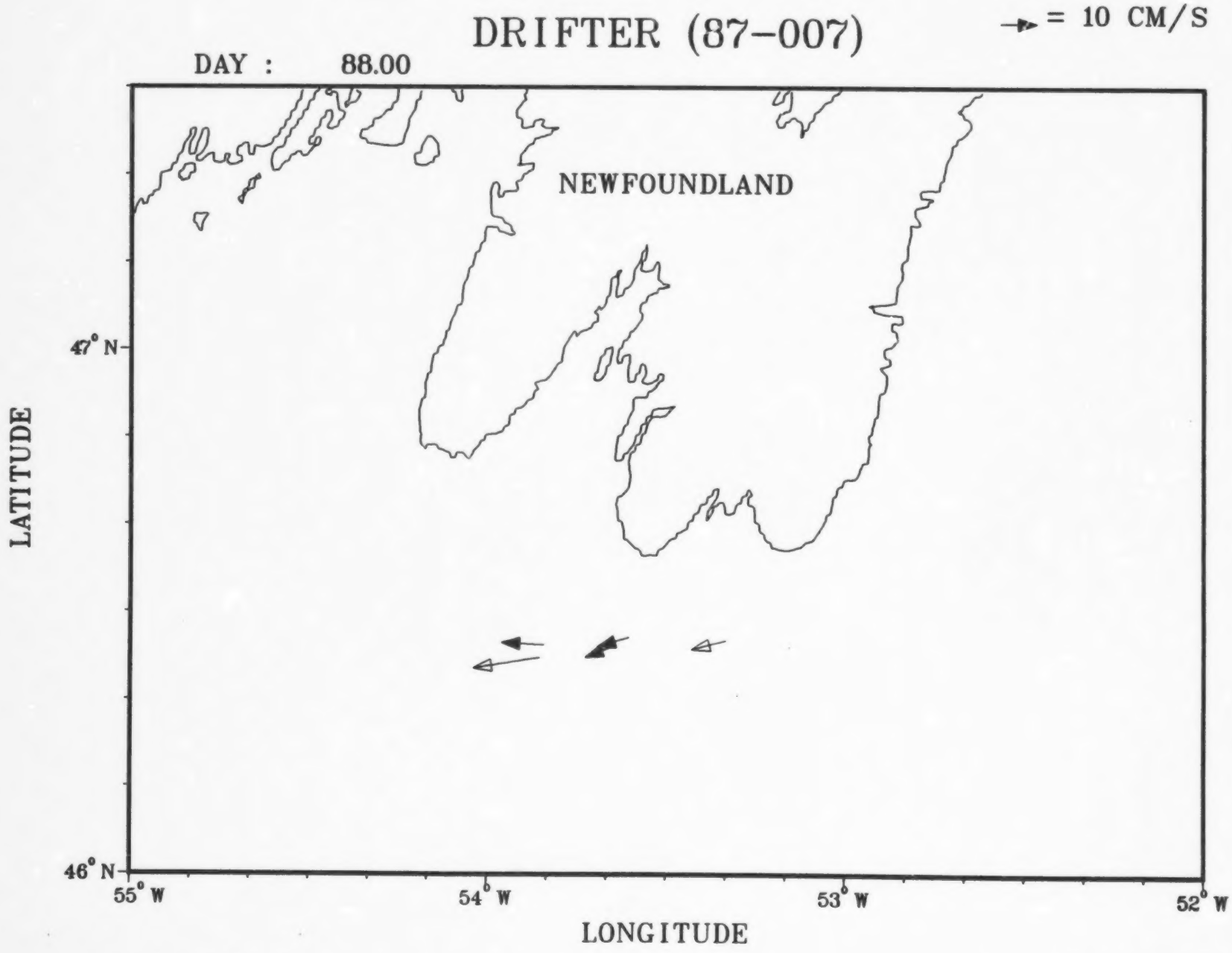
LATITUDE
46° N
47° N
55° W
54° W
53° W
52° W
LONGITUDE
DAY : 85.50
DRIFTER (87-007)
NEWFOUNDLAND
= 10 CM/S

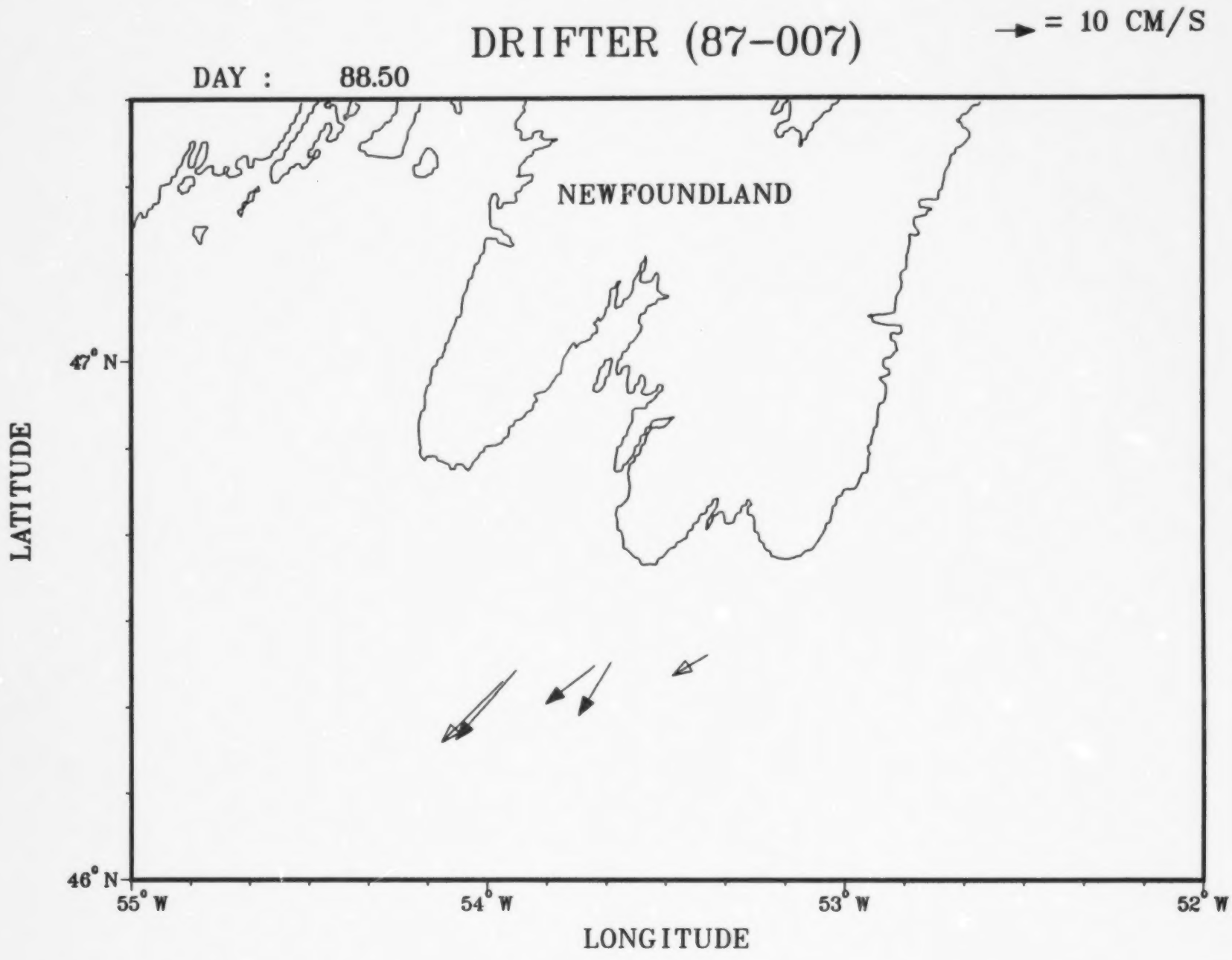

DRIFTER (87-007)
= 10 CM/S
DAY : 86.00
NEWFOUNDLAND
47° N
46° N
LATITUDE
55° W
54° W
53° W
52° W
LONGITUDE

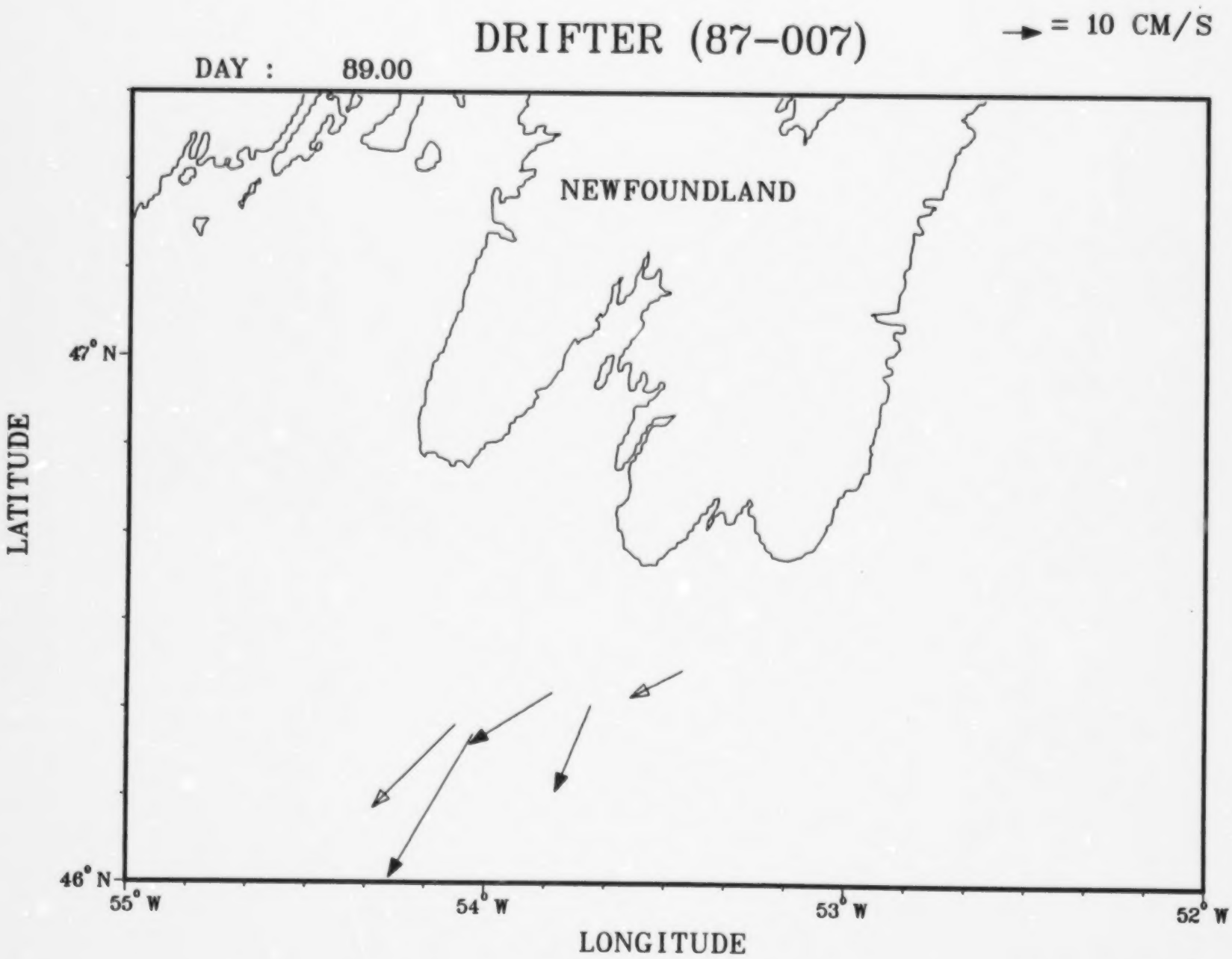

DRIFTER (87-007)
= 10 CM/S
DAY : 86.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

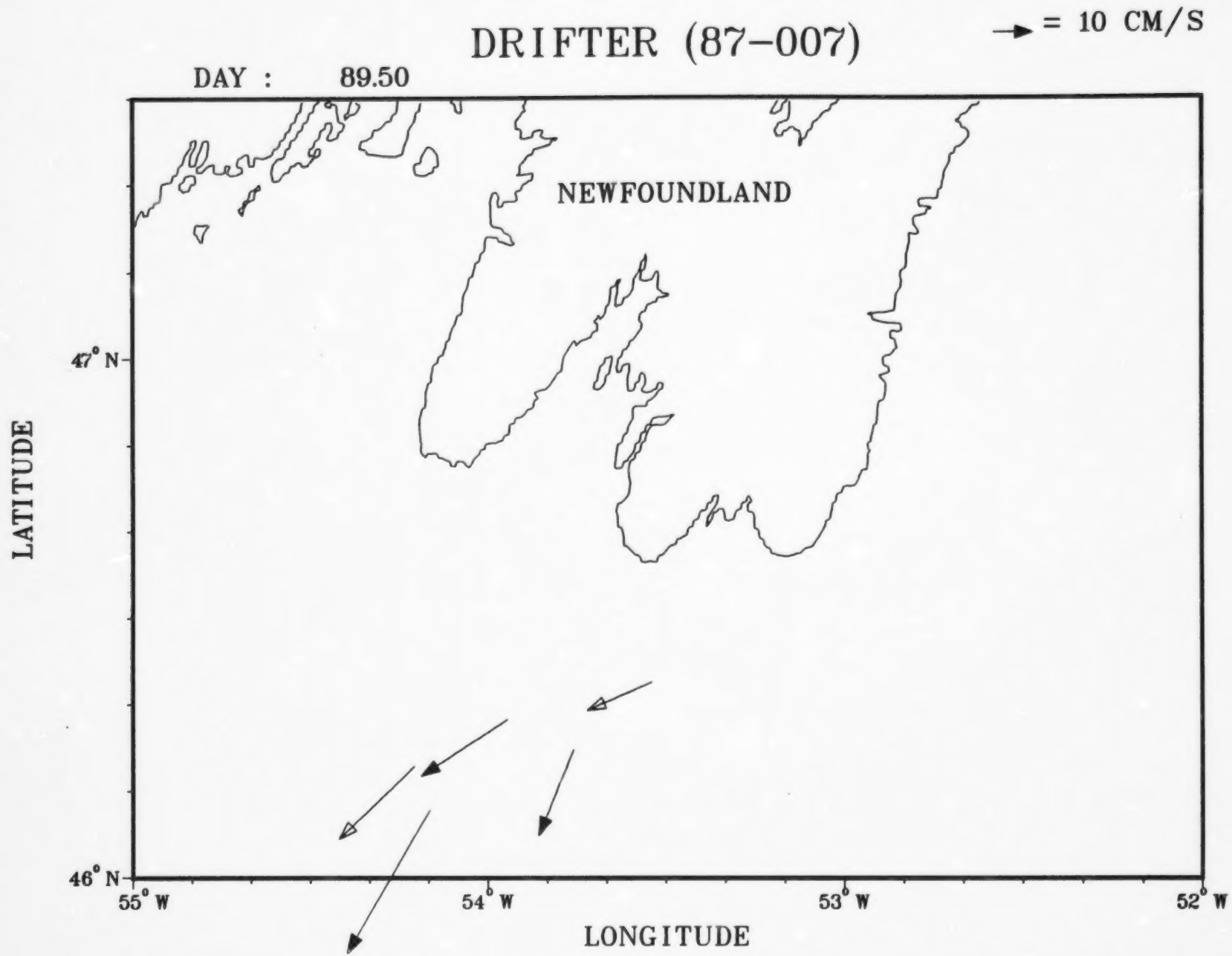

DRIFTER (87-007)
= 10 CM/S
DAY : 87.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

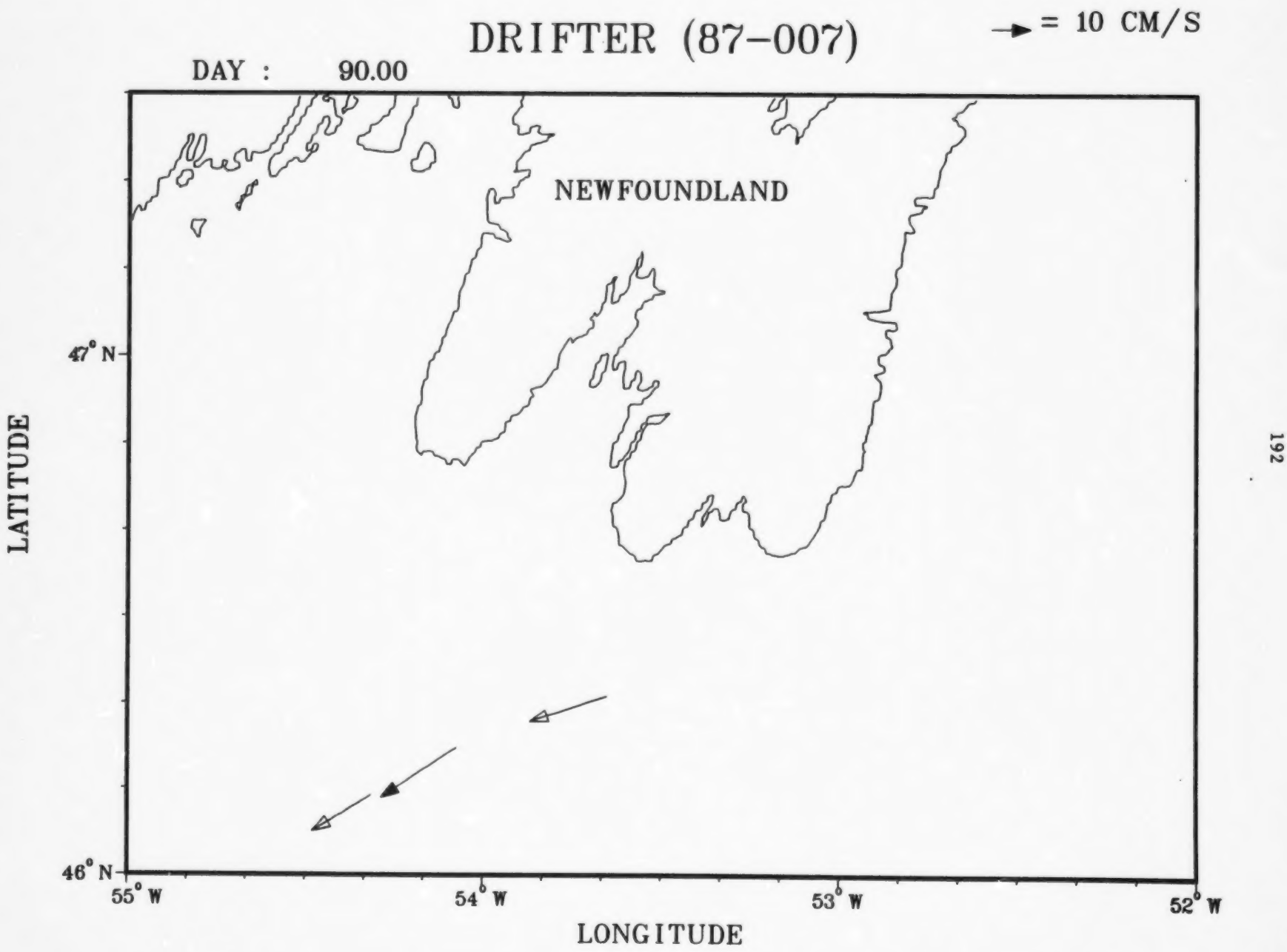
LATITUDE
47° N
46° N
55° W
54° W
53° W
52° W
LONGITUDE
DAY : 87.50
NEWFOUNDLAND
DRIFTER (87–007)
= 10 CM/S

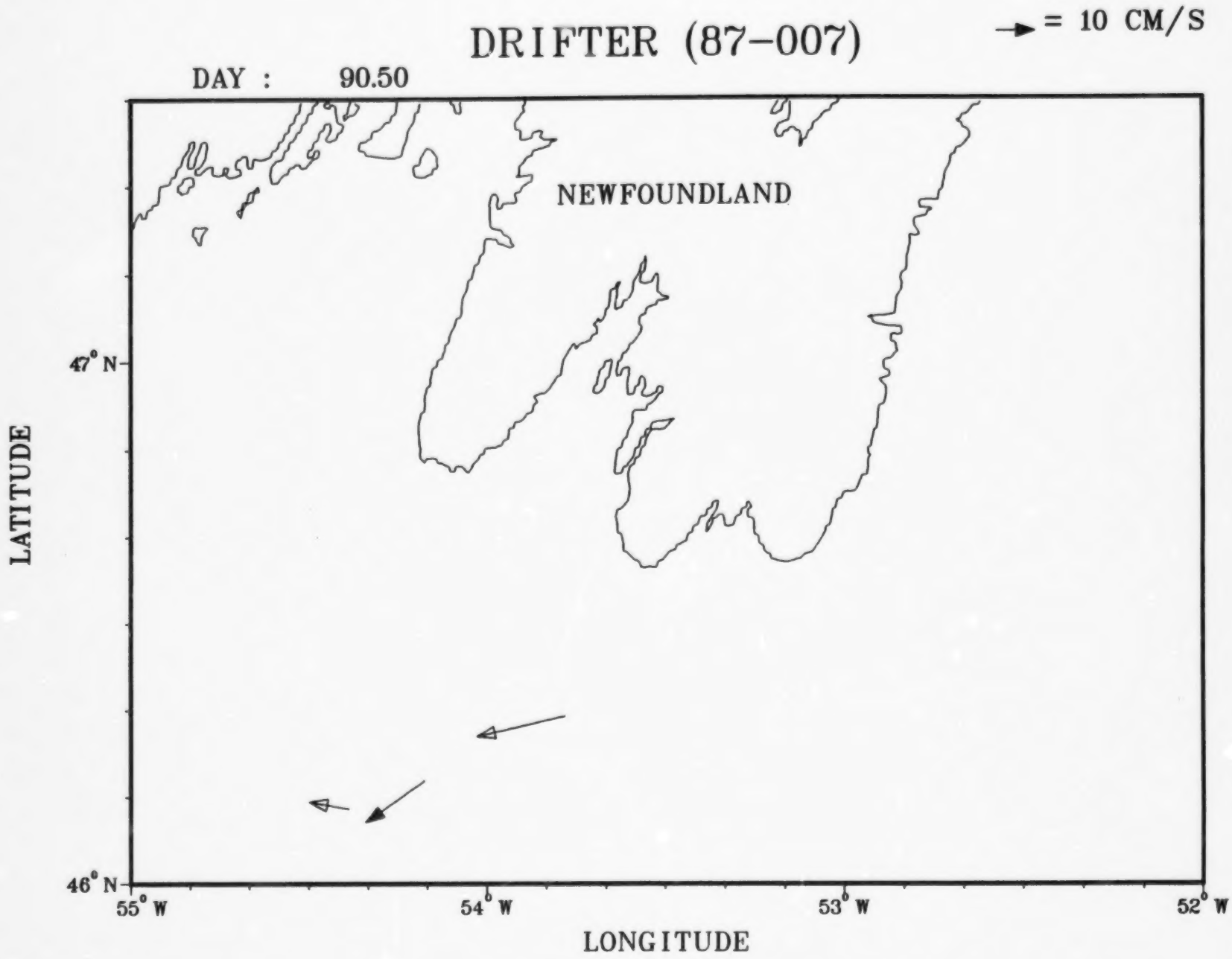

DRIFTER (87-007)
= 10 CM/S
DAY : 88.00
NEWFOUNDLAND
47° N
46° N
LATITUDE
55° W
54° W
53° W
52° W
LONGITUDE


DRIFTER (87-007)
= 10 CM/S
DAY : 88.50
NEWFOUNDLAND
47° N
46° N
LATITUDE
55° W
54° W
53° W
52° W
LONGITUDE

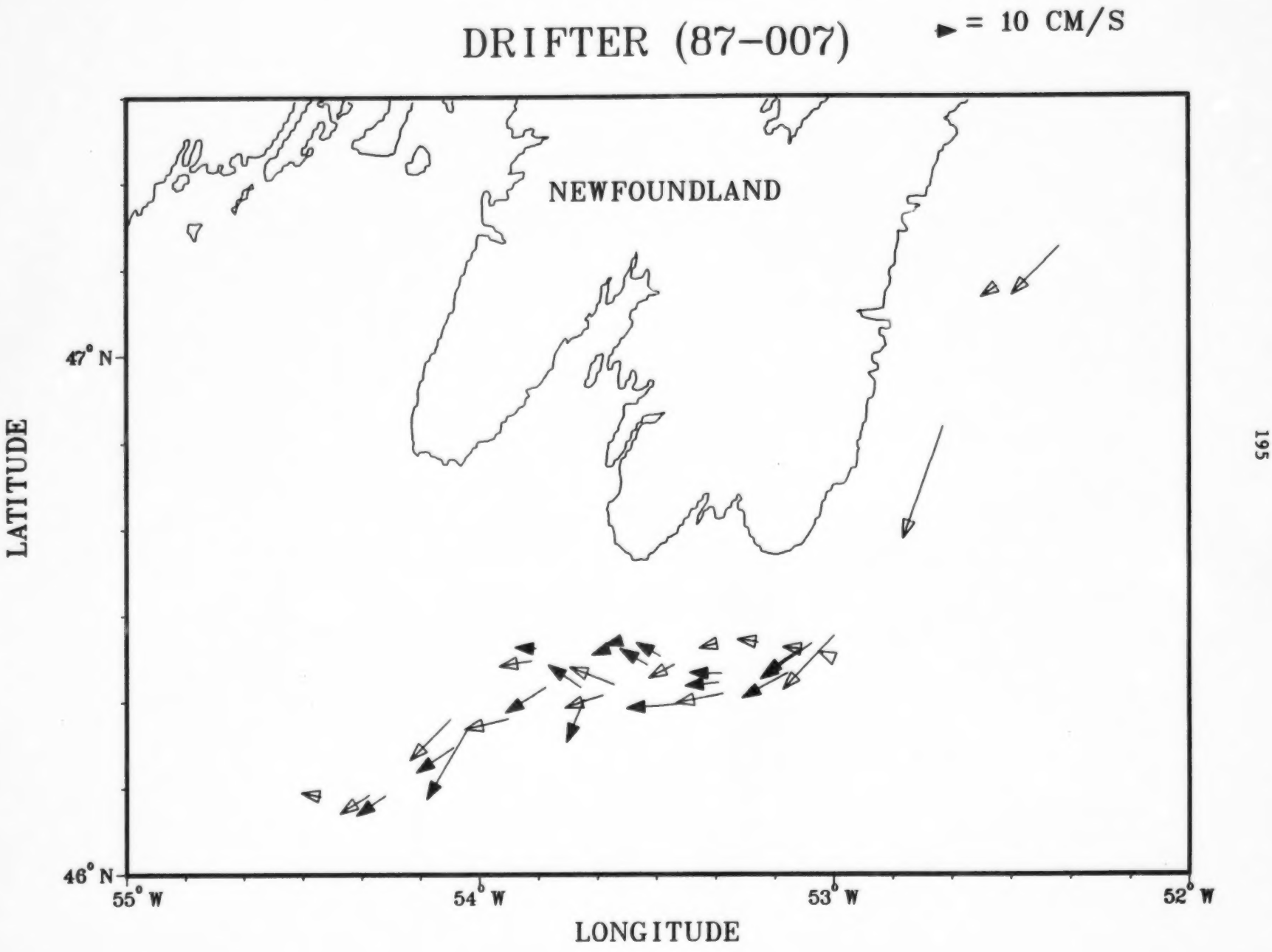

DRIFTER (87-007)
→ = 10 CM/S
DAY : 89.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

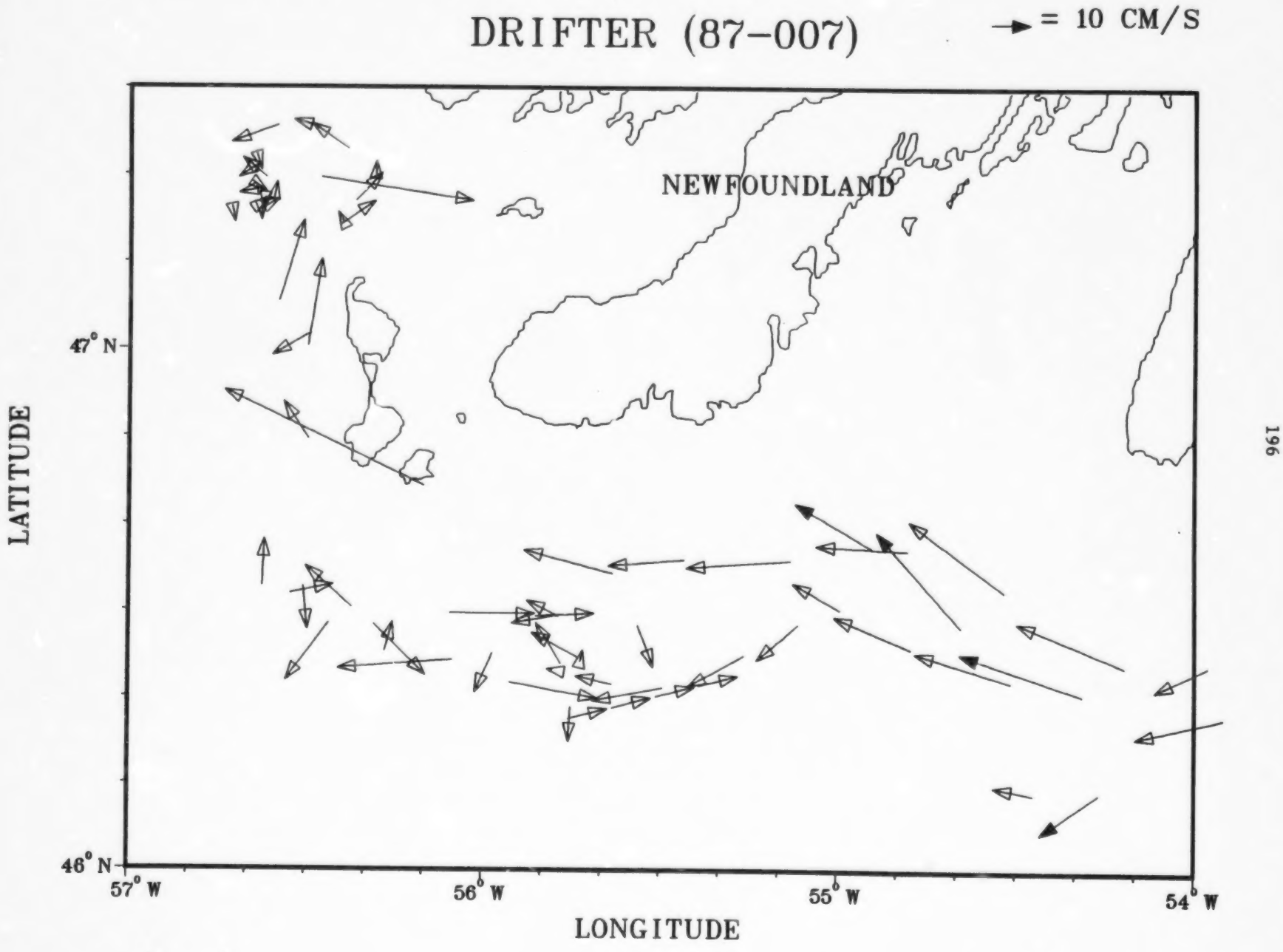

DRIFTER (87-007)
→ = 10 CM/S
DAY : 89.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE


DRIFTER (87-007)
= 10 CM/S
DAY : 90.00
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

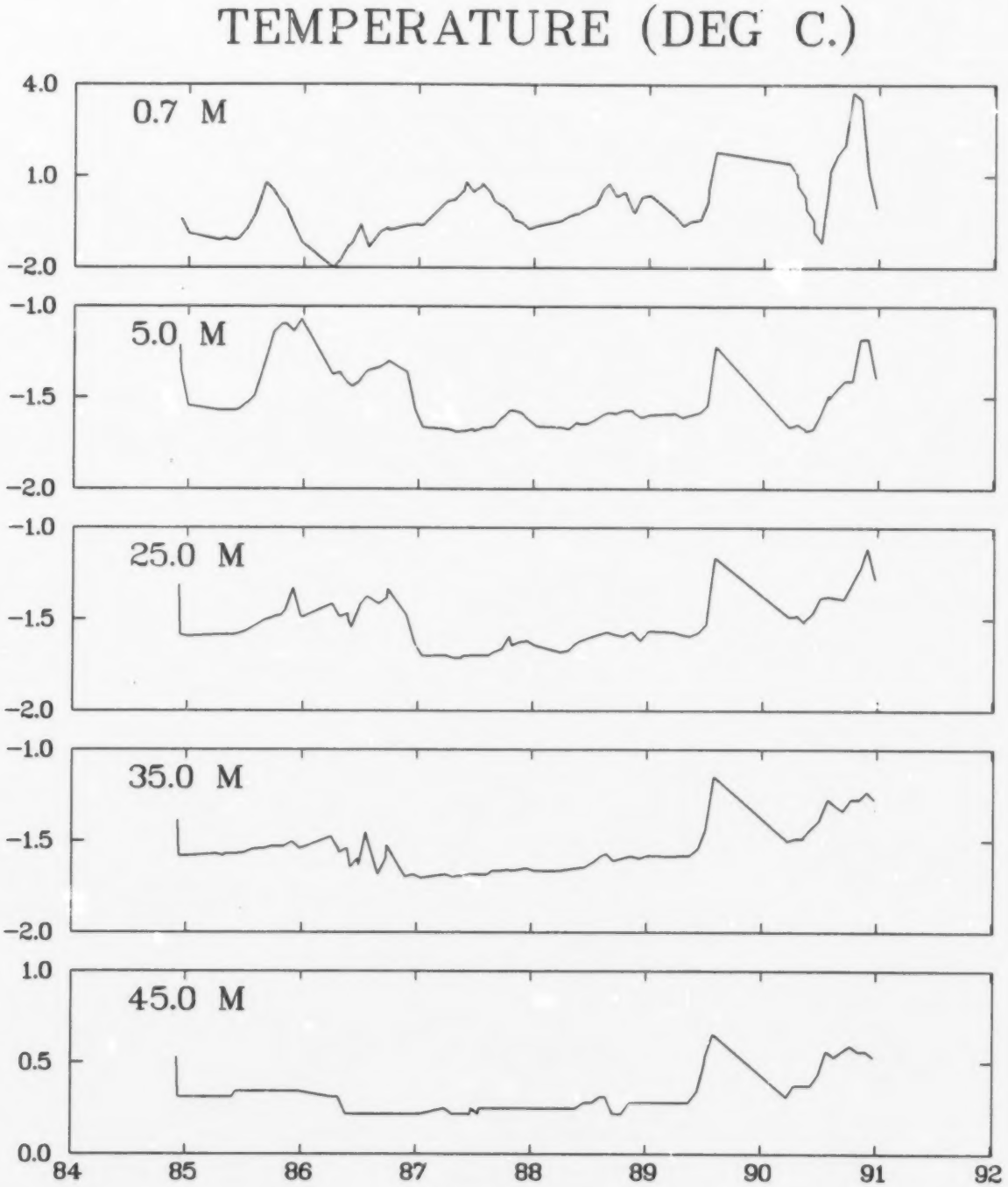

DRIFTER (87–007)
= 10 CM/S
DAY : 90.50
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

Composite drifter velocity

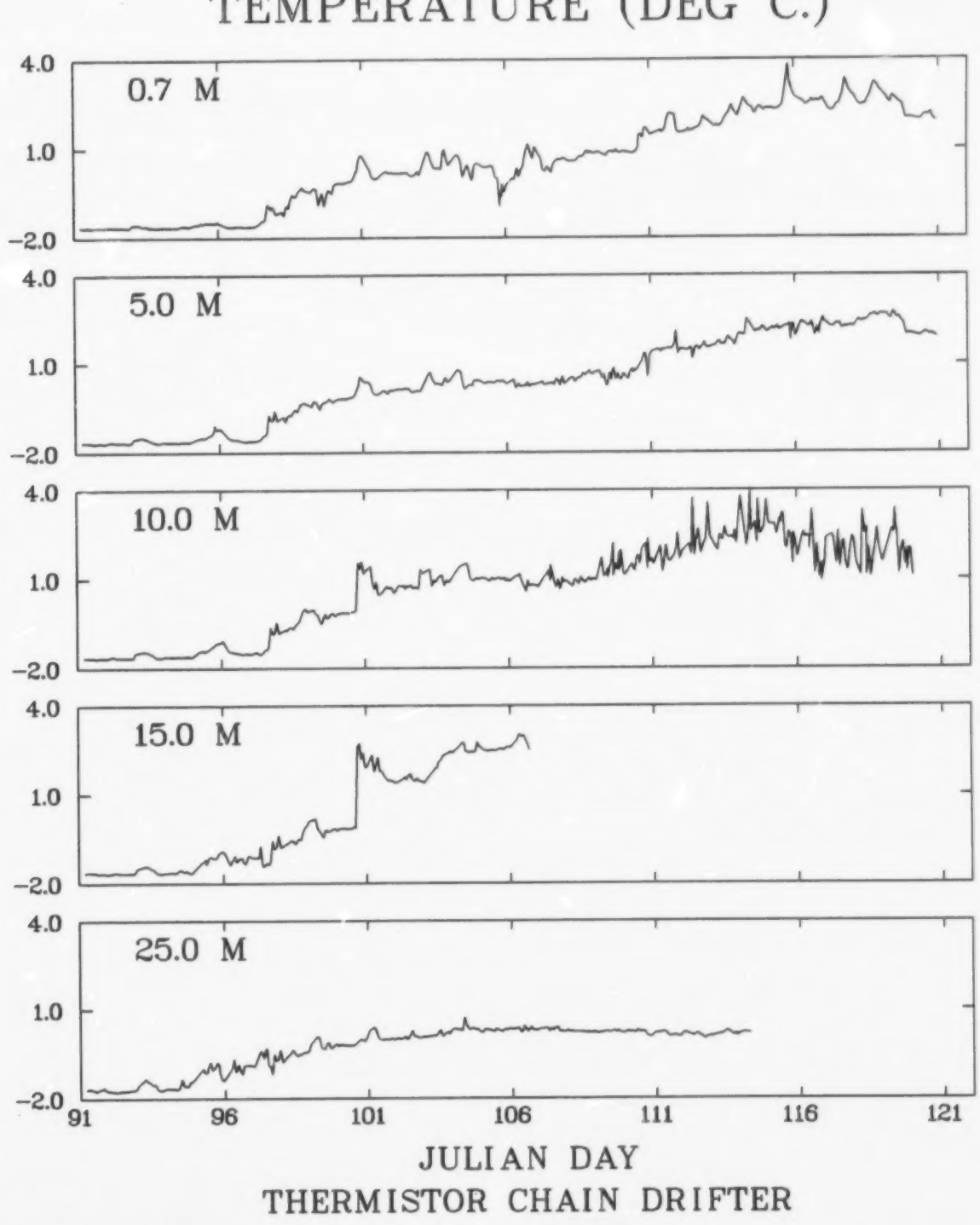

DRIFTER (87–007)
► = 10 CM/S
NEWFOUNDLAND
47° N
46° N
55° W
54° W
53° W
52° W
LATITUDE
LONGITUDE

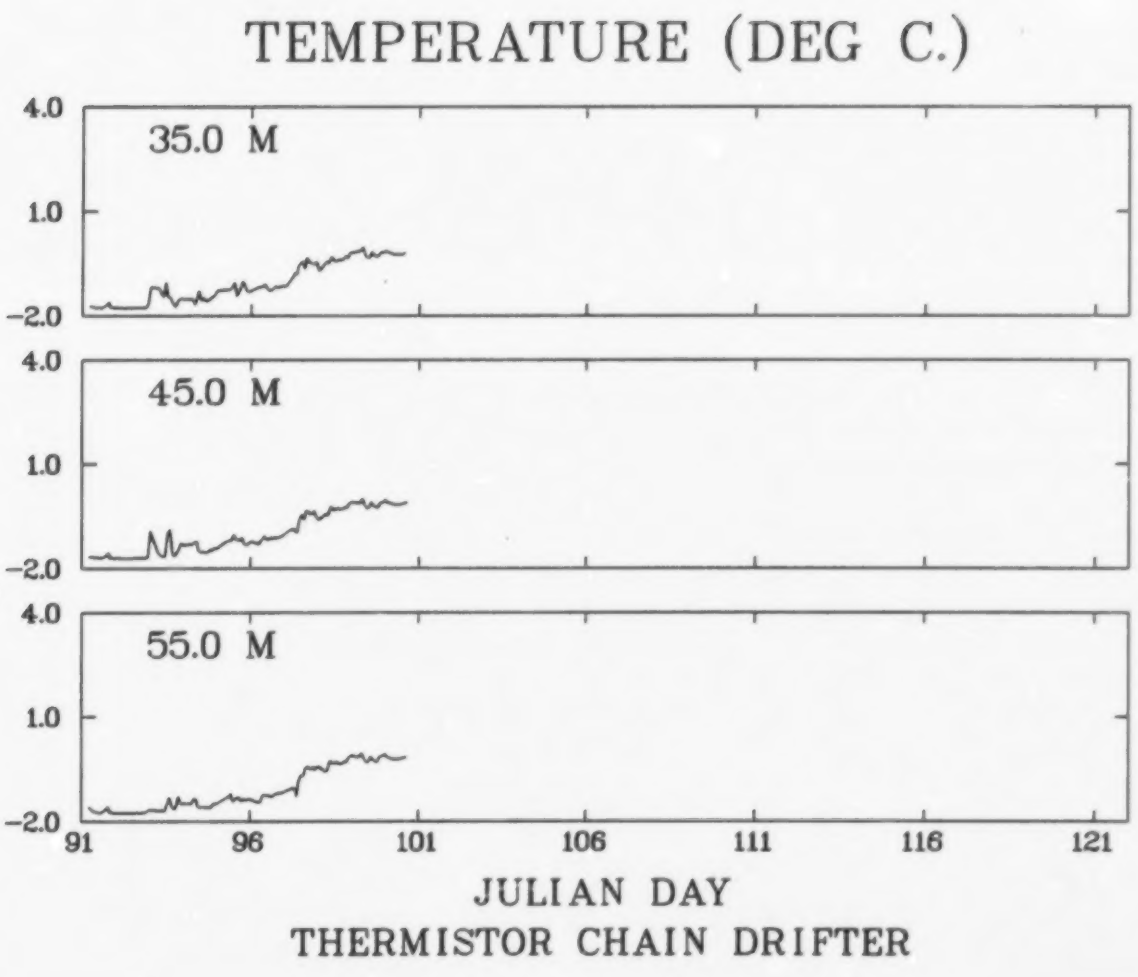

DRIFTER (87-007)
→ = 10 CM/S
NEWFOUNDLAND
47° N
46° N
57° W
56° W
55° W
54° W
LATITUDE
LONGITUDE

Temperature from thermistor chain drifter



THERMISTOR CHAIN DRIFTER


TEMPERATURE (DEG C.)
0.7 M
5.0 M
10.0 M
15.0 M
25.0 M
4.0
1.0
-2.0
91
96
101
106
111
116
121
JULIAN DAY
THERMISTOR CHAIN DRIFTER


TEMPERATURE (DEG C.)
4.0
1.0
-2.0
35.0 M
4.0
1.0
-2.0
45.0 M
4.0
1.0
-2.0
55.0 M
91
96
101
106
111
116
121
JULIAN DAY
THERMISTOR CHAIN DRIFTER

REFERENCES

Tang, C.L., M.Ikeda, S.D.Smith, L.McNutt, S.Digby-Argus, F.Carsey, J.Crawford, B.Holt, A.Lohanick, P. Wadhams, W.Winsor, W.L.Thomas III. Southern Labrador marginal ice zone study - a pilot field program of LIMEX. Can. Tech. Rep. Hydrog. Ocean Sci., No.99, 1987.

McNutt, L, S.Argus, F.Carsey, B.Holt, J.Crawford, C.Tang, A.L.Grey, C.Livingston. The Labrador ice margin experiment, March 1987 - a pilot experiment in anticipation of RADARSAT and ERS 1 data. EOS Trans. Am. Geophys. Union, 69, 634-635, 643, 1988.

MacLaren Plansearch Limited. Wave-ice interaction and sit-specific wave prediction during LIMEX/LEWEX '87 pilot project. Contractor's final report to Supply of Services Canada, 1988.

Appendix 1987 Calendar

Government of Canada 1987 Calendar

with Julian Calendar

Gouvernement du Canada Calendrier 1987

avec Calendrier Julien

JANUARY — JANVIER

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
				1 001	2 002	3 003
4 004	5 005	6 006	7 007	8 008	9 009	10 010
11 011	12 012	13 013	14 014	15 015	16 016	17 017
18 018	19 019	20 020	21 021	22 022	23 023	24 024
25 025	26 026	27 027	28 028	29 029	30 030	31 031

FEBRUARY — FÉVRIER

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
1 032	2 033	3 034	4 035	5 036	6 037	7 038
8 039	9 040	10 041	11 042	12 043	13 044	14 045
15 046	16 047	17 048	18 049	19 050	20 051	21 052
22 053	23 054	24 055	25 056	26 057	27 058	28 059

MARCH — MARS

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
1 060	2 061	3 062	4 063	5 064	6 065	7 066
8 067	9 068	10 069	11 070	12 071	13 072	14 073
15 074	16 075	17 076	18 077	19 078	20 079	21 080
22 081	23 082	24 083	25 084	26 085	27 086	28 087
29 088	30 089	31 090				

APRIL — AVRIL

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
			1 091	2 092	3 093	4 094
5 095	6 096	7 097	8 098	9 099	10 100	11 101
12 102	13 103	14 104	15 105	16 106	17 107	18 108
19 109	20 110	21 111	22 112	23 113	24 114	25 115
26 116	27 117	28 118	29 119	30 120		

MAY — MAI

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
					1 121	2 122
3 123	4 124	5 125	6 126	7 127	8 128	9 129
10 130	11 131	12 132	13 133	14 134	15 135	16 136
17 137	18 138	19 139	20 140	21 141	22 142	23 143
24 144 / 31 151	25 145	26 146	27 147	28 148	29 149	30 150

JUNE — JUIN

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
	1 152	2 153	3 154	4 155	5 156	6 157
7 158	8 159	9 160	10 161	11 162	12 163	13 164
14 165	15 166	16 167	17 168	18 169	19 170	20 171
21 172	22 173	23 174	24 175	25 176	26 177	27 178
28 179	29 180	30 181				

JULY — JUILLET

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
			1 182	2 183	3 184	4 185
5 186	6 187	7 188	8 189	9 190	10 191	11 192
12 193	13 194	14 195	15 196	16 197	17 198	18 199
19 200	20 201	21 202	22 203	23 204	24 205	25 206
26 207	27 208	28 209	29 210	30 211	31 212	

AUGUST — AOÛT

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
						1 213
2 214	3 215	4 216	5 217	6 218	7 219	8 220
9 221	10 222	11 223	12 224	13 225	14 226	15 227
16 228	17 229	18 230	19 231	20 232	21 233	22 234
23 235 / 30 242	24 236 / 31 243	25 237	26 238	27 239	28 240	29 241

SEPTEMBER — SEPTEMBRE

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
		1 244	2 245	3 246	4 247	5 248
6 249	7 250	8 251	9 252	10 253	11 254	12 255
13 256	14 257	15 258	16 259	17 260	18 261	19 262
20 263	21 264	22 265	23 266	24 267	25 268	26 269
27 270	28 271	29 272	30 273			

OCTOBER — OCTOBRE

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
				1 274	2 275	3 276
4 277	5 278	6 279	7 280	8 281	9 282	10 283
11 284	12 285	13 286	14 287	15 288	16 289	17 290
18 291	19 292	20 293	21 294	22 295	23 296	24 297
25 298	26 299	27 300	28 301	29 302	30 303	31 304

NOVEMBER — NOVEMBRE

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
1 305	2 306	3 307	4 308	5 309	6 310	7 311
8 312	9 313	10 314	11 315	12 316	13 317	14 318
15 319	16 320	17 321	18 322	19 323	20 324	21 325
22 326	23 327	24 328	25 329	26 330	27 331	28 332
29 333	30 334					

DECEMBER — DÉCEMBRE

SUN DIM	MON LUN	TUES MAR	WED MER	THURS JEU	FRI VEN	SAT SAM
		1 335	2 336	3 337	4 338	5 339
6 340	7 341	8 342	9 343	10 344	11 345	12 346
13 347	14 348	15 349	16 350	17 351	18 352	19 353
20 354	21 355	22 356	23 357	24 358	25 359	26 360
27 361	28 362	29 363	30 364	31 365		